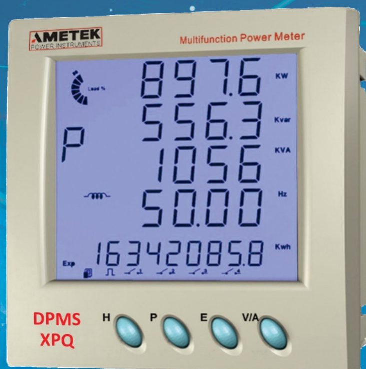
DPMS XPQ Multi-Function Power Meter

User Manual 1087-332



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Please read this manual carefully before installation, operation and maintenance of the DPMS XPQ meter.

The following symbols are used in this user’s manual and on the DPMS XPQ meter to alert the danger or to prompt in the operating or setting process.

Danger symbol, Failure to observe the information may result in injury or death.

Alert symbol, Alert to potential danger. Observe the information after the symbol to avoid possible injury or death.

Installation and maintenance of the DPMS XPQ meter should only be performed by qualified, competent personnel that have appropriate training and experience with high voltage and current devices.

AMETEK is not liable for any problems that occur under proper operation.

content

Getting Started!

Congratulations!

You have received an advanced, versatile, multifunction power meter, also known as a Remote terminal unit (RTU), which will greatly benefit your power system.

When you open the package, you will find the following items.

1. DPMS XPQ meter	1
2. 14-Pin terminal	2
3. Installation clips	4
4. User's operation manual	1
5. Maintenance guarantee card	1

Please read this manual carefully before operating or setting the meter to avoid unnecessary results. You can read only part of this manual depending on how you use the meter.

Chapter 1 helps you to understand the fundamental function, specification and application area.

Chapter 2 describes detailed installation and wiring.

Chapter 3 describes the data display and parameter setting method.

Chapter 4 outlines the functions of the meter and the way to use them.

Chapter 5 gives the address table.

Appendix lists the technical data and specifications and ordering information.

Chapter 1 Introduction

Purpose

Powerful Multifunction Power Meter

The DPMS XPQ series multifunction power meter is the new generation of the very popular DPMS. It has more functions and higher accuracy. It not only integrates three-phase energy measuring and displaying, energy accumulating, harmonic measuring, malfunction alarm, statistics and records, digital input / output and network communication, but also contains the following functions: four quadrant energy measuring, time-of-use (TOU), auto-freezing, waveform and over range waveform capture, programmable over range alarming, schedule of events, trending records etc. Graceful and high-lighted back light makes it easy to check the measuring data. Simple HMI interface makes it easy to master. The multi-row display lets you observe various data without touching any keys.

Ideal Choice for Electric Automation SCADA System

The DPMS XPQ can be used to replace all traditional electric meters. It also can be used as a Remote Terminal Unit (RTU) for monitoring and controlling in a SCADA system. All the measured data is available via digital RS485 communication ports running the ModbusTM protocol.

Energy Management

The DPMS XPQ can measure double direction four quadrant kWh and kVARh with accuracy up to class 0.5S of IEC60253-22. It can provide maximum/ minimum energy data and energy demand data. With the help of software, you can easily know how the load and energy are running. It also gives you all kinds of measurement tables.

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Remote Power Control

The main function of the DPMS XPQ is measurement, but it also has some flexible I/O functions. This makes the meter very useful as a distributed RTU (metering, monitoring, remote controlling in one unit).

Power Quality Analysis

With the powerful digital signal processing ability, the DPMS XPQ intelligent power meter can be used as an online power quality analysis instrument. It can simultaneously and continuously give out the analysis results such as THD of voltage and current, harmonics up to the 31st order and an unbalance factor of voltage and current, etc. Main functions of the DPMS XPQ are listed in table 1.1.

Metering	***Energy***
VLN, VLN average, VLL, VLL average. I, I average, IN. Power, Reactive Power, Apparent Power and Power factor of each phase and total. Frequency.	Bidirectional, four quadrants and system Energy, Reactive Energy, Apparent Energy Programmable energy freezing. Period Energy, Reactive Energy, Apparent Energy Four time zone schedules.
Statistics and Records	***Energy and Demand***
Max/Min value of statistics with time stamp Maximum of Demand SOE, Waveform capture and records	kWh, kVARh of 4 quadrants: Import, Export, Total, Net Demand of Power and Reactive Power
Power Quality Analysis	***Over range Alarming***
THD, Even THD and Odd THD of Voltage, Current Harmonics and Crest factor of Voltage Telephone Harmonic waveform Factor (THFF). Harmonics and K Factor. Unbalance Factor of Voltage and Current. Statistics of Voltage Eligibility.	Monitor up to 240 parameters. Programmable parameter limitations. Programmable alarming logic. Alarming outputs combined with DO or Relays. Auto-recording of alarming events. Alarming-trigger waveform recording.
Communication	***I/O port and Control***
RS485 Communication port. Modbus RTU Protocol	4 Digital Input (DI) (Wet or Dry) 2 Relay Output and 2 Digital Output (DO)

Table 1.1 Main functions of the DPMS XPQ series

Application Area

Power Distribution Automation Intelligent Electric Switch Gear
Industry Automation Building Automation
Energy Management System Large UPS System

Function

Multifunction, High Accuracy

The DPMS XPQ sSeries multifunction Intelligent power meter is powerful in data collecting and processing. Electric power parameters; metering, energy accumulating ,harmonic measuring, malfunction alarming, statistics and records, digital input /output and network communication, four quadrant energy measuring, time-of-use(TOU), auto-freezing, waveform and over range waveform capture, programmable over range alarming, schedule of events, trending records etc.

Accuracy of Voltage and Current is 0.2%, True-RMS
Accuracy of Power and Energy is 0.5%, four quadrants metering.

Small Size and Easy Installation

With the size of DIN96 ×96 and 55mm depth after mounting, the DPMS XPQ can be installed in a small cabin. The fixing clips are used for easy installation and removal.

Easy to Use

With a large high density LCD screen, the display of the DPMS XPQ is easy to read and use. All the setting parameters can be accessed by using panel keys or a communication port. The setting parameters are protected in

EEprom, which will maintain its content after the meter is powered off. With the backlight of the LCD, the display can be easily read in a dim environment. The back light "on" time is selectable.

Multiple Wiring Modes

The DPMS XPQ can easily be used in either: high voltage, low voltage, three phase three wires, three phase four wires or a single phase system. High safety, high stability, the DPMS XPQ was designed according to industrial standards. It can run stably under high power disturbance conditions as it has passed IEC and CE.

Comparison

To meet different demands of customers, the DPMS XPQ series consists of four types: DPMS XPQ-D (time-of-use pattern), DPMS XPQ-E (power quality pattern), DPMS XPQ-F (waveform and alarming pattern) and DPMS XPQ-G (general function pattern). In order to introduce them all, this manual is based on the DPMS XPQ-G. Other patterns may not contain some functions so please refer to the following table carefully.

Table 1.2 Comparison of the DPMS XPQ series

Function	***D***	***E***	***F***	***G***
Basic parameters	●	●	●	●
Digital I/O	●	●	●	●
Demand	●	●	●	●
Basic settings	●	●	●	●
Device property	●	●	●	●

Harmonics	THD	Phases and all		●	●	●
		phase		●		●
	Voltage harmonic analysis			●		●
	current harmonic analysis			●		●

Function			***D***	***E***	***F***	***G***
Sequence				●	●	●
phase angle				●	●	●
Energy	Real time		●	●	●	●
	Current month TOU		●			●
	Previous month TOU		●			●
	Accumulative TOU		●			●
	Frozen	Real time	●			●
		Current month TOU	●			●
		Accumulative TOU	●			●
MAX/MIN	Current			●	●	
	Previous			●	●	
Voltage eligibility	Daily, Monthly, Yearly, Frozen, Accumulative			●		●
SOE log					●	●
Alarm log				●	●	●
Waveform log					●	●
Trending log					●	●
System status	Alarming record			●	●	●
	SOE, waveform, trending				●	●
	Schedule of TOU		●			●
	Run time		●	●	●	●
Alarm	Alarming			●	●	●
	Waveform triggering				●	●
Others	Max and Min recording mode			●	●	●
	Trending settings				●	●

Chapter 2 Installation

Note: Before trying to operate the meter, note the functions according to its pattern. The installation method is introduced in this chapter. Please read this chapter carefully before beginning installation work.

Appearance and Dimensions

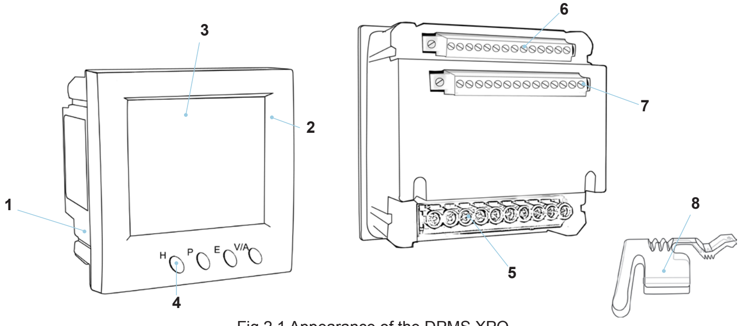


Fig 2.1 Appearance of the DPMS XPQ

PART NAME	*DESCRIPTION*
1. Enclosure	The DPMS XPQ enclosures are made of high strength anti-combustible engineered plastic
2. Front	Casing After the installation, this part is before the panel. The color of the front casing is optional
3. LCD	Display Large bright blue backlight LCD Display
4. Key	Four keys are used to select display and to set parameters of the meter
5. Input Wiring	Terminals Used for Voltage and Current input
6. Auxiliary Wiring	Terminals Used for auxiliary power, communication and DI
7. Extend Wiring	Terminals Auxiliary I/O wiring terminals
8. Installation Clip	The clips are used for fixing the meter to the panel

Table2.1 Part Names of the DPMS XPQ

Dimensions

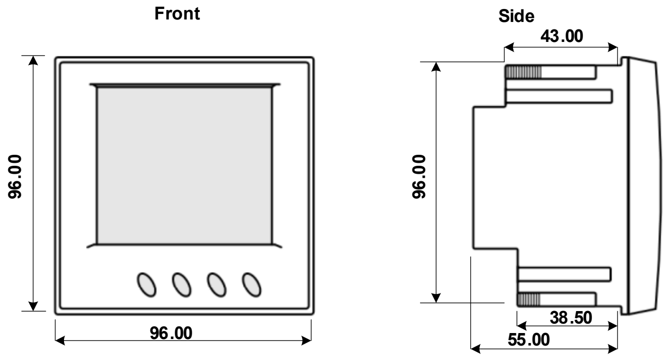


Fig 2.2 Dimensions

Installation Method

Environmental

Before installation, please check the environment temperature and humidity to ensure the DPMS XPQ meter is being placed where optimum performance will occur.

Temperature

Operation: -25 - 70 deg.

Storage: -40 - 85 deg.

Humidity

5% - 95% non-condensing

The meter should be installed in a dry and dust free environment and avoid heat, radiation and high electrical noise sources.

Maximum Altitude: 2,000m

Site Requirement: Indoor Use

Installation Steps

Normally, meters are installed on the panel of switch gear.

1. First, cut a square hole on the panel of the switch gear. The cutting size is in fig 2.3 Unit (mm)

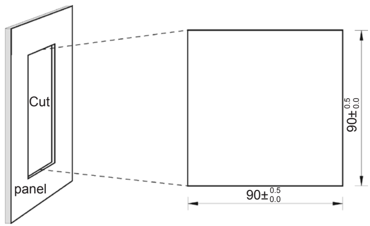


Fig 2.3 Panel Cutting

2. Second, remove the clips from the meter and insert the meter into the square hole from the front side.

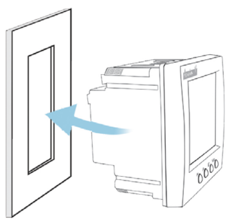


Fig 2.4 Put the meter into the square hole

3. Finally, install clips back on the meter from the backside and push the clip tightly so that the meter is affixed on the panel.

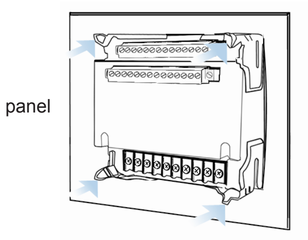


Fig 2.5 Use the clips to affix the meter on the panel

Space required for Installation

The space around the meter should be large enough so that the meter removal, terminal strip wiring and wire arrangement could be done easily. The recommended minimum space around the meter is shown in Table 2.2 and Fig 2.6.

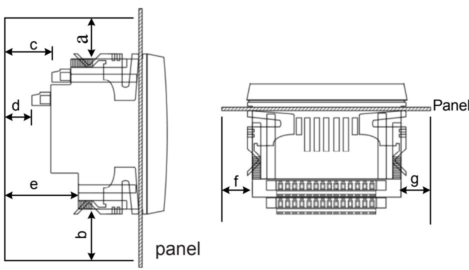


Fig 2.6 Space around the meter

Environment Temperature	Minimum Distance(mm)						
	a	b	c	d	e	f	g
□50□	25	25	38	38	64	25	25
≥50□	38	38	51	51	76	38	38

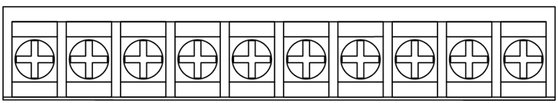
Table 2.2 Minimum Space

Wiring

Terminal Strips

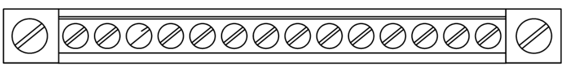
There are three terminal strips on the back: Voltage & Current input, Auxiliary and Extend. Only the DPMS XPQ with the PRIO option has the Extend Terminal Strip. The 1, 2 and 3 are used to represent each phase of a three phase system. They have the same meaning with A, B and C or R, S and T in a three phase system.

Voltage & Current Input Terminal Strip



VOLTAGE INPUTS				CURRENT INPUTS					
V1	V2	V3	Vn	I11	I12	I21	I22	I31	I32
1	2	3	4	5	6	7	8	9	10

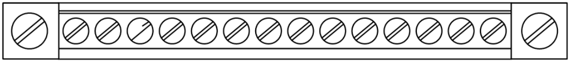
Auxiliary Terminal Strip



RS-485				DIGITAL INPUTS				AUX. POWER					
A	B	S	NC	DI1+	DI1-	DI2+	DI2-	NC	L	NC	N	NC	G
11	12	13	14	15	16	17	18	19	20	21	22	23	24

Note: NC means No Connection

Extend Terminal Strip



DIGITAL INPUTS				DI POWER		RELAY OUTPUTS				DIGITAL OUTPUTS			
DI3+	DI3-	DI4+	DI4-	V+	V-	R11	R12	R21	R22	DO1+	DO1-	DO2+	DO2-
25	26	27	28	29	30	31	32	33	34	35	36	37	38

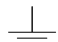
Fig 2.7 Terminal Strips

DANEROUS

Only qualified personnel should do the wire connection work. Make sure the power supply is off and all the wires are powerless. Failure to observe this may result in severe injury or death.

Safety Earth Connection

Before doing the meter wiring connection, please make sure that the switch gear has a safety Earth system. Connect the meter safety earth terminal to the switch gear safety earth system. The following safety earth symbol is used in this user's manual.



Note

Make sure the auxiliary power terminal of the meter, G, is connected to the safety Earth of switchgear.

Auxiliary Power

The auxiliary power supply of the meter is 100-240Vac (50/60Hz) or 100-300Vdc. The meter's typical power consumption is less than 2W. A regulator or a UPS should be used when the power supply undulates too much. The terminals for the auxiliary power supply are 20, 22 and 24 (L, N, G). A switch or circuit-breaker should be included in the building installation, and it should be in close proximity to the equipment and within easy reach of the operator, and it should be marked as the disconnecting device for the equipment.

Note

Make sure the power supply voltage is the same as what the meter needs for its auxiliary power.

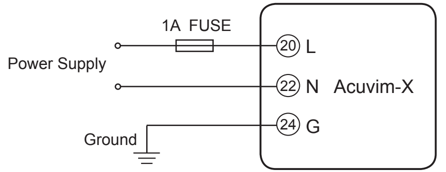


Fig 2.8 Wiring of Power Supply

A fuse (typical 1A/250Vac) should be used in the auxiliary power supply loop. No.24 terminal must be connected to the safety earth system of switchgear. An isolated transformer or EMI filter should be used in the auxiliary power supply loop if there is a power quality problem in the power supply.

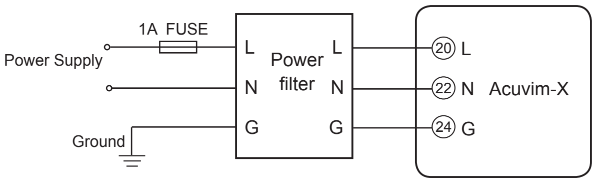


Fig 2.9 Wiring of Aux. Power Supply with power line filter

Choice of wire should be AWG22~16 or 0.6~1.3mm^2.

Note: A filter should be used if there is an EMI problem.

Note

The secondary of PT can not be shorted, otherwise it may cause the severe damage of the instrument.

Voltage Input

Meter input voltage should be 40~230Vac L-N, 60~400Vac. L-L. The voltage input could be directly connected to the meter terminal without the use of PT if the voltage system is less than 400Vac (L-L). If the input Voltage is higher than 400Vac, a PT or VT should be

used. A fuse (typical 1A/250Vac) should be used in the voltage input loop. A PT should be used to transform the high voltage into the measurement range of the meter if it is used in a high voltage system. The wire gauge of the input voltage should be AWG16~12 or 1.3~2.0mm^2.

Note: In no circumstances should the PT secondary be shorted. The PT secondary should be well grounded at one end.

Current Input

In a practical engineering application, CTs should be installed in the measuring loop. Normally the CT secondary is 5A. 1A is possible as an option. A CT accuracy over 0.5% (rating over 3VA) is recommended and it will influence the measuring accuracy. The wire between the CT and meter should be as short as possible. The length of the wire may increase the error of the measurement. CTs must be required for rated current over 5A.

The wire guage of the input current should be AWG15~10 or 1.5~2.5mm^2.

Note: The CT loop should not be open in any circumstances when the power is on. There should not be any fuse or switch in the CT loop and one end of the CT loop should be connected to the ground.

Vn Connection

Vn is the reference point of meter input voltage. The lower the wire resistance the lower the error.

Three phase wiring diagram

The DPMS XPQ can satisfy most kinds of three phase wiring diagrams. Please read this part carefully before you begin to do the wiring so that you may chose a wiring diagram suitable for your power system.

The voltage and current input wiring mode can be set separately in the meter parameter setting process. The voltage wiring mode could be 3-phase 4-line Wye (3LN), 3-phase 4-line 2PT Wye mode (2LN) and 3-phase 3-line open delta (2LL). The current input wiring mode could be 3CT, 2CT and 1CT. Any voltage mode could be grouped with one of the current modes.

3-Phase 4-Line Wye mode (3LN)

The 3-Phase 4-Line Wye mode is commonly used in low voltage electric distribution power systems. The power line can be connected to the meter voltage input directly as in fig 2.10a. In the high voltage input system, 3PT Wye mode is often used as in fig 2.10b. The voltage input mode of the DPMS XPQ should be set to 3LN for both voltage input wiring modes.

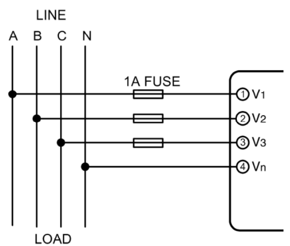


Fig 2.10a 3LN direct connection

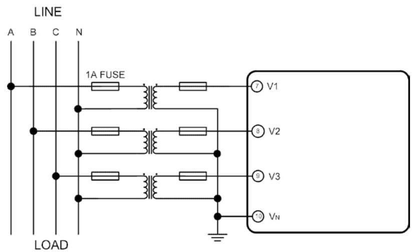


Fig 2.10b 3LN with 3PT

3-Phase 3-Line direct connection mode (3LN)

In a 3-Phase 3-Line system, power line A, B and C are connected to V1, V2 and V3 directly. Vn is floated. The voltage input mode of the DPMS XPQ should be set to 3LN.

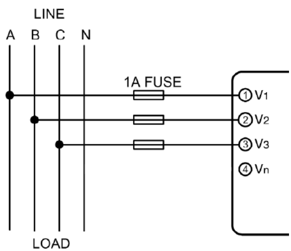


Fig 2.11 3LN 3-Phase 3-Line direct connection

3-Phase 4-Line 2PT mode (2LN)

In some 3-Phase 4-Line Wye systems, 2PT Wye mode is often used as in fig 2.12. It is supposed that the 3 phases of the power system are balanced. The voltage of V2 is calculated according to V1 and V3. The voltage input mode of the DPMS XPQ should be set to 2LN for 2PT voltage input wiring mode.

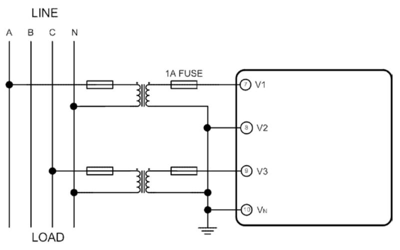


Fig 2.12 2LN with 2PTs

3-Phase 3-Line open Delta Mode (2LL)

Open delta wiring mode is often used in high voltage systems. V2 and Vn connect together in this mode. The voltage input mode of the DPMS XPQ should be set to 2LL for voltage input wiring mode.

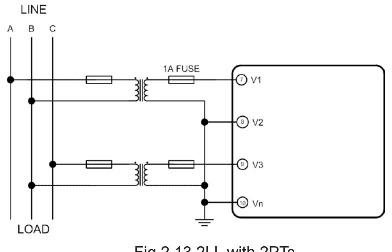


Fig 2.13 2LL with 2PTs

Current Input Wiring

3CT

All current input of a three phase system can be viewed as 3CT, whether there are 2 CTs or 3 CTs on the input side. The current input mode of the DPMS XPQ should be set to 3CT for this current input wiring mode.

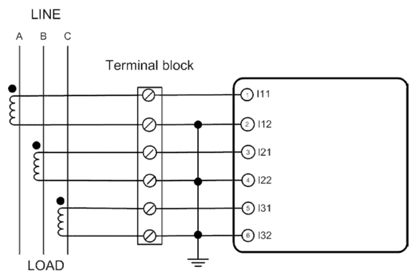


Fig 2.14 3CT-a

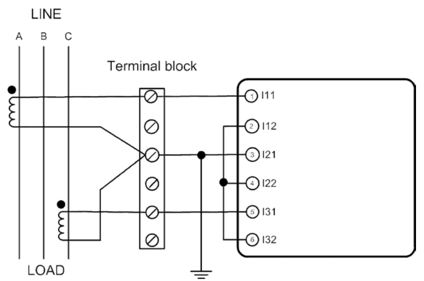


Fig 2.15 3CT-b

2CT

The difference in fig. 2.16 and fig. 2.15 is that there is not current input in the I21 and I22 terminals. The I2 value is calculated from formula i1+i2+i3=0. The current input mode of the DPMS XPQ should be set to 2CT for this current input wiring mode.

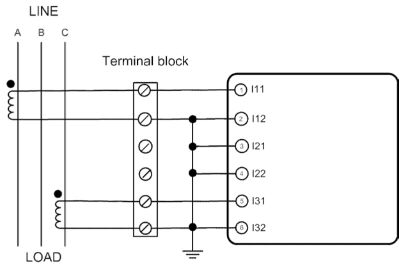


Fig 2.16 2CT

1CT

If it is a three phase balanced system, a 1 CT connection method can be used. The other two currents are calculated according to the balance supposing.

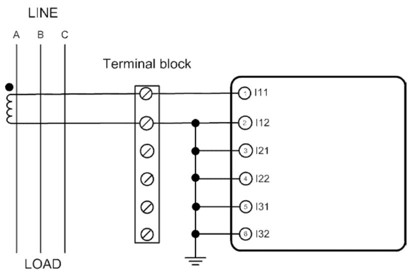


Fig 2.17 1CT

Frequently used wiring method

The voltage and current wiring method are put together in one drawing. The DPMS XPQ meter will display normally only if the setting of the meter is associated with the wiring of the voltage and current input.

1. 3LN, 3CT with 3 CTs

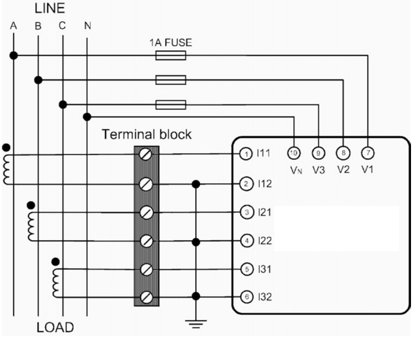


Fig 2.18 3LN, 3CT with 3CTs

2. 3LN, 3CT with 2 CTs

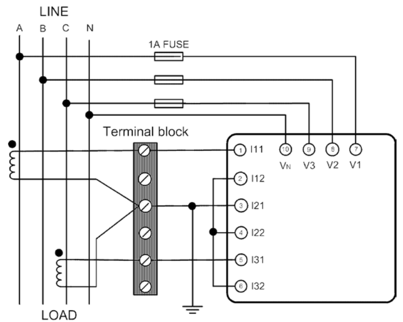


Fig 2.19 3LN, 3CT with 2 CTs

3. 2LN, 2CT

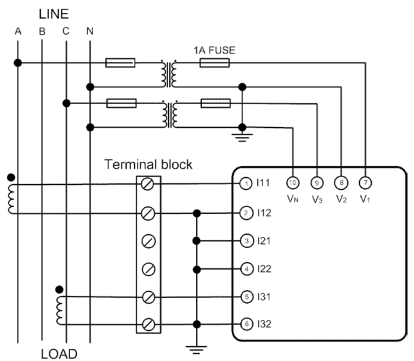


Fig 2.20 2LN, 2CT

4. 2LN, 1CT

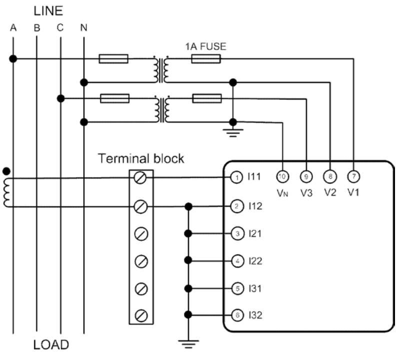


Fig 2.21 2LN, 1CT

5. 2LL, 3CT

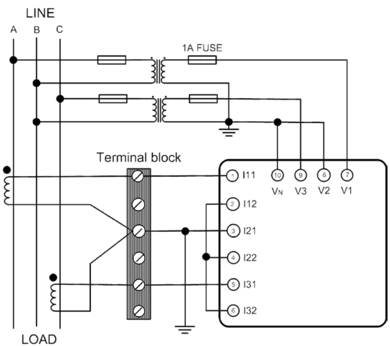


Fig 2.22 2LN, 3CT

6. 2LL, 2CT

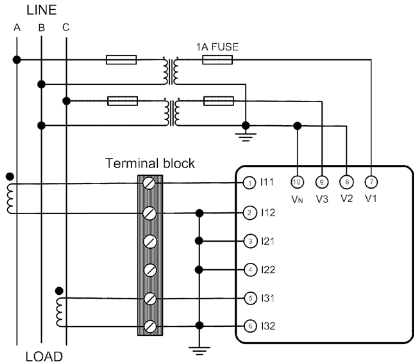


Fig 2.23 2LL, 2CT

7. 2LL, 1CT

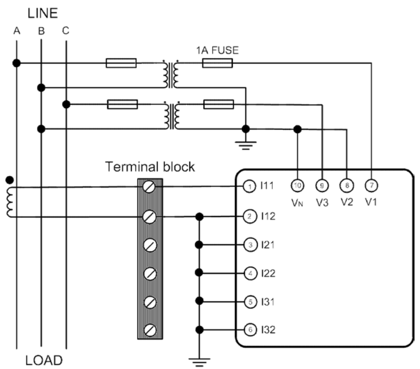


Fig 2.24 2LL, 1CT

8. Single Phase 2 Line (Wiring mode setting 3LN, 3CT)

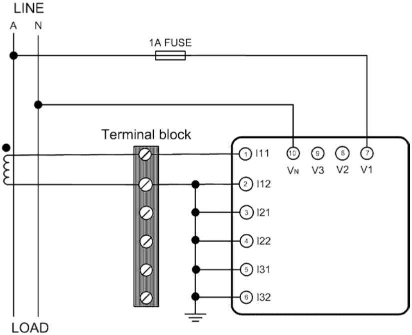


Fig 2.25 Single Phase 2 Lines

9. Single Phase 3 Line (Wiring mode setting 3LN, 3CT)

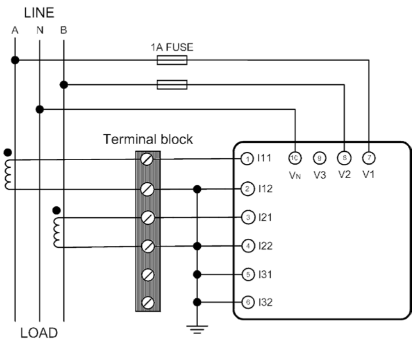


Fig 2.26 Single Phase 3 Line

Wiring of Digital Inputs

There are two digital inputs of wet contact in the standard DPMS XPQ. The terminals of the two digital inputs are DI1+, DI1- (15, 16) and DI2+, DI2- (17, 18). Additional two digital inputs are optional. The terminals of the two additional digital inputs are DI3+, DI3-(25, 26) and DI4+, DI4-(27, 28). The circuit drawing of the digital input is simplified in fig 2.27.

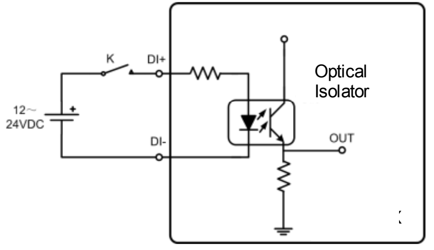


fig 2.27 Digital Input Circult of the DPMS XPQ

The auxiliary power supply for the digital input is 12~24Vdc. If the connection wire is too long, a relative higher voltage should be adopted. The current in the loop line should be 10mA~15mA, and the Max current is 30mA.

A DI auxiliary power supply (optional) is provided for the convenience of field use. The voltage of the DI auxiliary power supply is 15Vdc (1W). The wiring terminals are V+ and V- (29, 30). This power supply can not be used for any other purpose.

The 4 DIs with the auxiliary power supply is in fig 2.28. The wire for digital input should be between AWG22 ($0.5mm^2$)~ AWG16 ($1.3mm^2$).

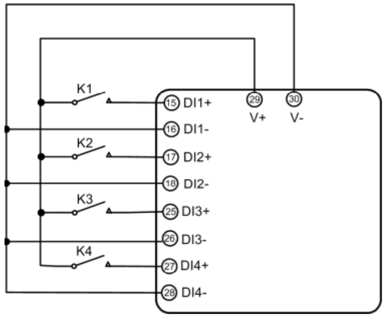


Fig 2.28 Digital Input with Auxiliary Power

Relay Output (RO)

There are two additional relay output options for the DPMS XPQ. The terminals are R11, R12 (31, 32) and R21, R22 (33, 34). These two relay outputs are used for remote control electric switches in the power system.

The relay type is mechanical Form A contact with 3A/250Vac or 3A/30Vdc. A mediate relay is recommended in the output circuit shown in fig 2.29.

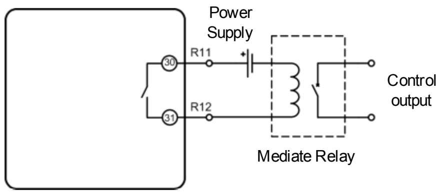


Fig 2.29 Relay output

There are two mode selections for relay output, one is latching, and the other is momentary. For the latching mode, the relay can be used to output two states, on or off. For the momentary mode, the output of the relay changes from off to on for a period of time Ton and then goes off. Ton can be set from 50-3000ms.

The wire for relay output should be between AWG22 (0.5mm^2)~AWG16 (1.3mm^2).

Digital Output (DO)

There are two digital outputs as an option. The terminals of the digital output are DO1+, DO1-(35, 36) and DO2+, DO2-(37, 38). These two digital outputs can be used as an energy pulse output or over limit alarming output. The digital output circuit form is Photo-MOS. The simplified circuit is in fig 2.30.

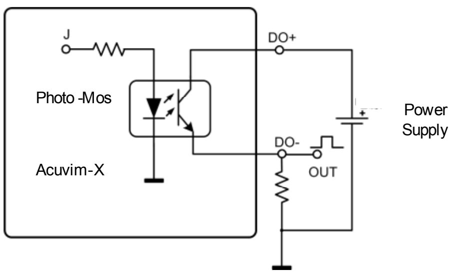


Fig 2.30 Digital output Circuit

The Max output voltage and current are 100V and 50mA.

When the digital output is used as pulse output, DO1 and DO2 can be

programmed as energy pulse output. For example, DO1 is used as energy pulse output and DO2 is used as reactive energy pulse output. The pulse width and pulse constant can be set.

When the digital output is used as an over limit alarm output, the upper and lower limit of the parameter, time interval and output port can be set. A drawing of the alarming output with beeper is in fig 2.31.

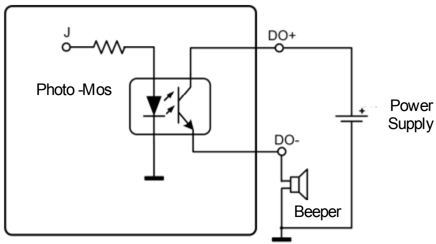


fig 2.31 Do Alarming Circuit

The wire for digital output should be between AWG22 (0.5mm^2) ~AWG16 (1.3mm^2).

Communication

The communication port and protocol of the DPMS XPQ are RS485 and Modbus-RTU. The communication terminals are A, B, and S (11, 12, 13). A is differential signal +, B is differential signal - and S is connected to the shield of the twisted pair cable. Up to 32 devices can be connected on an RS485 bus. Use good quality shielded twisted pair cable, AWG22 (0.5mm^2) or larger. The

overall length of the RS485 cable connecting all devices can not exceed 1200m (4000ft). The DPMS XPQ is used as a slave device of a master like a PC, PLC, data collector or RTU.

If the master does not have an RS485 communication port, a converter has to be used. Normally a RS232/RS485 or USB/RS485 is adopted. The topology of RS485 net can be line, circle and star.

1. Line

The connection from master to meter is one by one in the RS485 net as in fig 2.32.

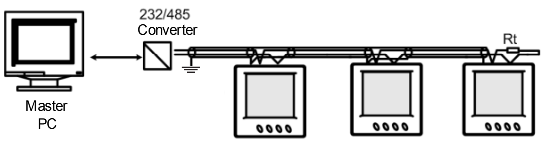


fig 2.31 Line Mode

In fig 2.32 the Rt is an anti-signal reflecting resistor 120-300 ohm/0.25W. Normally, it is added to the end of the circuit beside the last meter, if the communication quality is not good.

2. Circle

Meters are connected in a closed circle for the purpose of high reliability. There is no need for anti-signal reflecting resistors.

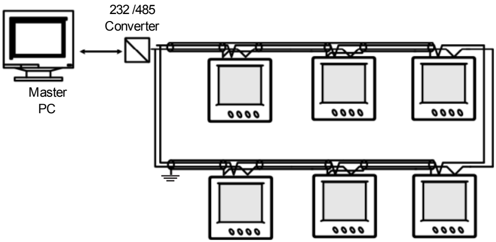


fig 2.31 Circle Mode

3. Star

The connection for RS485 net is in Wye mode. An anti-signal reflecting resistor may be needed in each line.

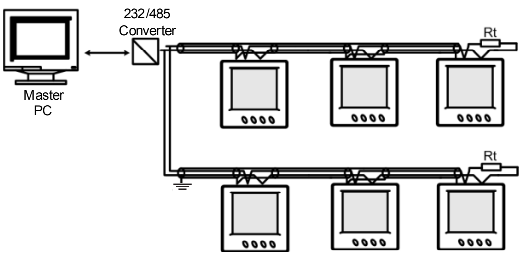


fig 2.31 Star Mode

Recommendations for high quality communication:

☞ Good quality shielded twisted pair of AWG22 (0.6mm2) or larger is very important.

☞ The shield of each segment of the RS485 cable must be connected to the ground at one end only.

☞ Keep communication cables as far away as possible from sources of electrical noise.

☞ Use an RS232/RS485 or USB/RS485 converter with optical isolated output and surge protection.

Chapter 3 Meter Operation and Parameter Setting

Display Panel and Keys

Metering Data Reading

Statistics Display

Meter Parameter Setting

Energy Parameter Setting

Voltage Eligibility Parameter Setting

Detailed human-machine interface of the meter will be described in this chapter. It includes how to get the metering data and how to do the parameter setting. This chapter is based on the DPMS XPQ-G, but other patterns can be operated the same way.

Display Panel and Key

There is one display panel and four keys in the front of meter. All the display segments are illustrated in fig 3.1.

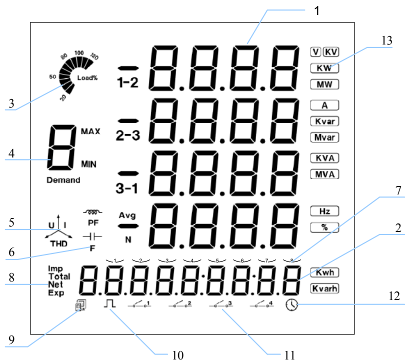


fig 3.1 All display segments

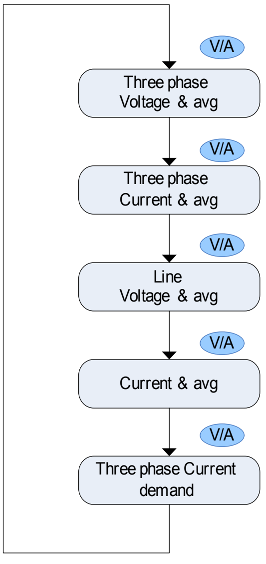
Table 3.1 Display Panel description

SN	Display	Description
1	Four lines of 8 letter in the metering area	Display metering data: Voltage, Current, Power, Power factor, Frequency, THD, Demand, Unbalance factor, Max/Min Value etc.
2	One line of 8 letter in the energy display area	Energy data display or real time clock
3	Load rate	Display load current to rating current percentage
4	Item label 8 letter, MAX, MIN, Demand, PF and F	Item label: U: voltage, I: current, P: power, q: reactive power, S: apparent power, PF: power factor, F: frequency, MAX: Maximum value, MIN: Minimum Value, Demand:Demand value, Avg: average value, I with N: neutral current, PF, F, Avg and N indicate the data in the fourth line.
5	Three phase unbalance label	With letter U: Voltage unbalance factor With letter I: Current unbalance factor
6	Load characteristic	Capacitor label: capacitive load; Inductor: inductive load
7	TOU indicator	1, 2, 3, 4 stands for sharp, peak, normal and valley
8	Energy label	imp: consumption energy; exp: generating energy; total: absolute sum of imp and exp energy; net: algebraic sum
9	Communication indicator	No label: no communication; One label: inquiry Two labels: inquiry and answer
10	Energy pulse output indicator	No label: no pulse output; With label: pulse output
11	Digital input indicator	Switch 1 to 4 indicate DI1 to DI4
12	Time label	Time display in energy area
13	Unit	Indicate data unit Voltage: V, kV, Current: A, Power: kW and MW, Reactive Power: kVar and MVar, Apparent Power: kVA and MVA, Frequency: Hz, Energy: kWh, Reactive Power: kVARh, Percentage: %

There are four keys on the front panel, labeled as H, P, E and V/A from left to right. Use these four keys to read metering data and set the parameters.

Metering Data Reading

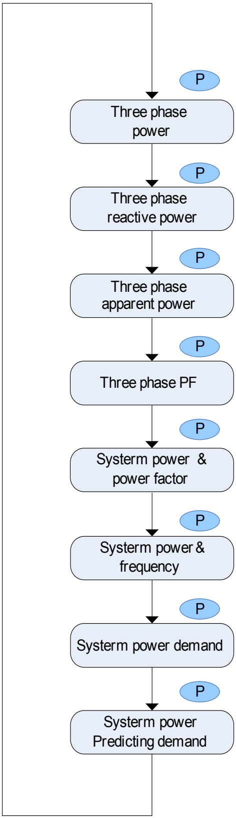
Normally, it displays the metering data, such as voltage, current, power etc. There are several key patterns: press H, P, E, V/A and press key P and key V/A simultaneously.



Press V/A to read voltage and current in the metering area. The screen will roll to the next display as you press V/A each time. It will go back to the first screen if you press V/A at the last screen.

Table on the left shows you how it scrolls:

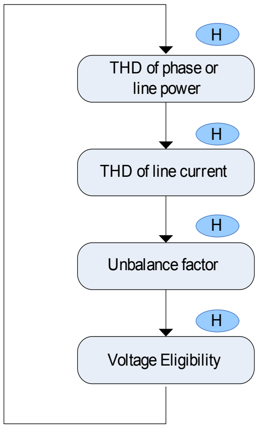
Note: When the meter is set to “2LL”, there is no phase voltage and neutral current display. So only the third, fourth and fifth screens will be displayed.



Press P, to display power related data. The screen will scroll to the next display as you press P each time. It will go back to the first screen if you press P at the last screen.

Table on the left shows you how it scrolls:

Note: When the meter is set to “2LL”, the first to the fourth screens will not be displayed.



Press H, to display power quality data, including THD, unbalance factor and voltage eligibility. The screen will scroll to the next display as you press H each time. It will go back to the first screen if you press H at the last screen.

The following table shows you how it scrolls:

Note 1: Some patterns do not have these functions so the key function and display are invalid.

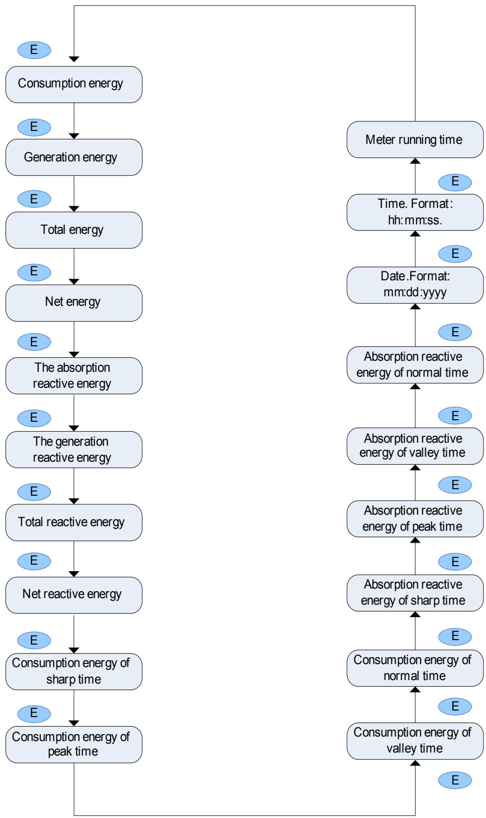
Note 2: When the meter is set to “2LL”, THD, unbalance factor and voltage eligibility are based on the line-to-line voltage; otherwise they are based on the phase voltage.

Press E to display energy and the real time clock. The screen will scroll to the next display as you press E each time. It will go back to the first screen if you press E at the last screen.

The unit of power is kWh and kVARh for reactive power. The running time begins to record at the time when the meter is turned on, with the accuracy of 0.01H and is stored in the nonvolatile memory. It can be reset via communication port.

The following table shows you how it scrolls:

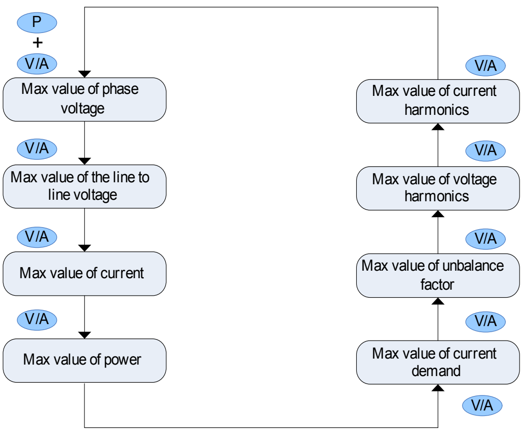
Note: Patterns without TOU functions will not display the 9th~16th screens.


E
Consumption energy
E
Generation energy
E
Total energy
E
Net energy
E
The absorption reactive energy
E
The generation reactive energy
E
Total reactive energy
E
Net reactive energy
E
Consumption energy of sharp time
E
Consumption energy of peak time
E
Consumption energy of valley time
E
Consumption energy of normal time
E
Absorption reactive energy of sharp time
E
Absorption reactive energy of peak time
E
Absorption reactive energy of valley time
E
Absorption reactive energy of normal time
E
Date.Format: mm:dd:yyyy
E
Time. Format: hh:mm:ss.
E
Meter running time

Statistics Display

Press the P and V/A keys simultaneously, the Max and Min value of metering data will be displayed on the screen. The time stamp can be accessed through the communication port. P is used to change the display between MAX and MIN, V/A is used to scroll the screen. The screen will scroll to the next display as you press V/A each time. It will go back to the first screen if you press V/A at the last screen. It will exit whenever you press P and V/A Keys simultaneously.

The following shows you how it scrolls:



Note: Set to "2LL", there is no display of "Max value of phase voltage".

> **Note**
>
> The secondary of the PT can not be shorted, otherwise it may cause severe damage to the instrument.

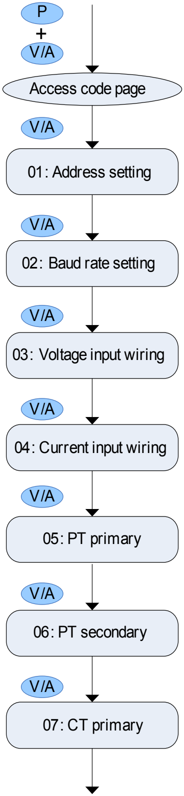
Meter Parameter Setting

Under the metering data display mode, press the H and V/A key simultaneously, to get into the meter parameter setting mode. Most of the settings can be done through the keys on the panel.

In the meter parameter setting mode, press H to move the cursor. Right moves one digit each time. Press P for increasing and press E for decreasing. Press V/A for acknowledgment and going to the next setting item page. Press H and V/A page keys simultaneously to exit in any setting item page.

An access code is needed to access the parameter setting mode. Only the person who knows the access code can do the parameter setting. The access code is 4 digits decimal. It is from 0000 - 9999. The factory default is 0000. After you key in the right access code, press V/A to go to the first parameter setting page, otherwise go back to the metering data display page.

The following table shows you how to set it:



01: It is any digit from 1 - 247.

02: 1200, 2400, 4800, 9600, 19200, 38400bps are available.

03: Voltage input could be one of three modes, 3LN, 2LN and 2LL. (Refer to chapter 2)

04: could be one of the three modes, 3CT, 2CT and 1CT. (Refer to chapter 2)

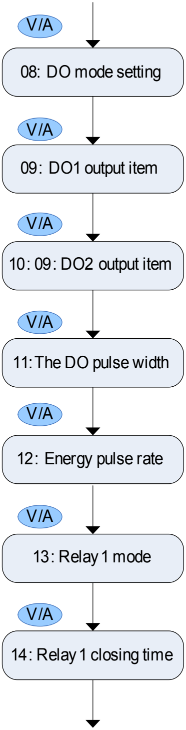
05: PT1 value is an integer from 50.0 - 500000.0, the unit is volt.

06: PT2 value is an integer from 100 - 400. The unit is volt. If there is no PT on the voltage input side of meter, the PT1 and PT2 should be the same and equal to the input rated voltage.

07: CT1 value is an integer from 5 - 50000 for a 5 Amp rated current meter, and 1 - 50000 for a 1 Amp rated current meter.

08: Output mode of DO can be set as alarm (AL) and pulse (PLS).

09: It is an integer from 0 - 4 and stands for no output, consumption energy, generation energy, absorption



reactive energy and generation of reactive energy respectively.

10: The same as DO1 for setting, and they don't affect each other.

11: The DO pulse width is an integer from 1 - 50. One digit is 20ms.

12: Pulse rate means the energy value per pulse. It can be an integer of 1 - 6000. One digit is 0.1kWh or 0.1kVarh.

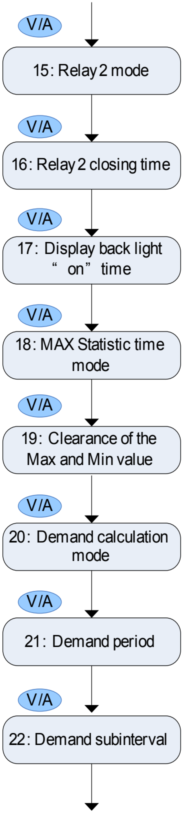
13: For the latching mode, the relay can be used to output two states: on or off. For the momentary mode, the output of the relay changes from off to on for a period of time, Ton and than goes off. Ton can be set from 50-300ms. (0: latching; 1: momentary).

14: When the relay mode is set to momentary, the closing time, Ton is an integer from 50 - 3000ms.

15: The same as Relay1.

16: The same as Relay1 and they don't affect each other.

17: The "on" time can be set from 0 - 120 minutes. The back light will always be "on" if the setting value is 0. If it is another value, it means after a long time it goes off if no key has been pressed. It will be "on" whenever you



press any key if it is "off".

18: 0 and 1 stands for current month and current day respectively.

19: To clear the Max and Min value does not mean write 0 to all the registers, it will copy the metering value to the statistic registers and start a new statistic period.

20: 1,2,3,4 stands for sliding window, fixed window, rolling window and thermal respectively.

21: 1 - 60 minutes are available.

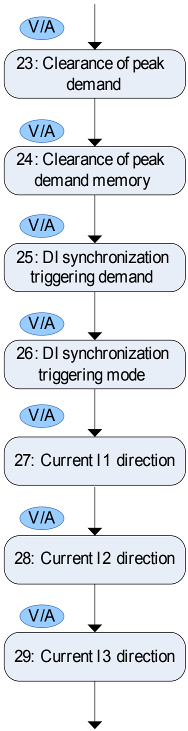
22: 1 - 60 minutes are available, but the demand period must be divided exactly by the demand subinterval.

23: To clear demand memory means set "0" to all the registers used in the demand calculation.

24: To clear the peak demand means just set "0" to the peak demand registers and will not affect others.

25: "0" stands for no synchronous triggering, "1" for DI1 as the trigger, "2" for DI2 as the trigger, "3" for DI3 as the trigger and "4" for DI4 as the trigger.

26: "1" stands for from OFF to ON; "2" stands for from



ON to OFF; “3” stands for trigger at any change.

27, 28, and 29: To adjust polarity of the current, the three currents direction can be set as “Negative” which means reversing 180 degrees and “Positive” which means normal.

30: “yes” means alarming is available and “no” means not.

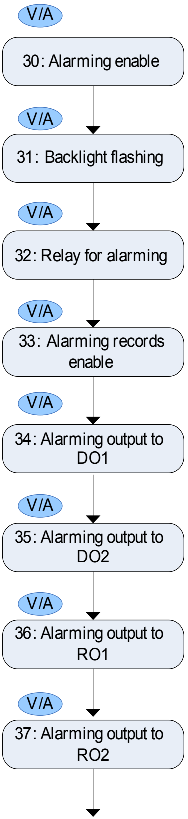
31: “yes” means the backlight flashes during alarming.

32: “yes” means the relay works in alarming mode and “no” for remote controlling mode.

33: There are 16 records in all and each one is corresponding to one bit of a 16-bit register. For each record, it works or not depends on the enable setting. If some bits of the register are “1”, it means their corresponding records take effect. While “0” means they don’t work. On the panel, it is set as decimal but in the register it is binary, so it needs conversion.

34: When DO1 works in alarming mode, it is controlled by a 16-bit register which determines which record will output to DO1. On the panel, it is set as decimal but in the register it is binary, so it needs conversion.

35: When DO2 works in alarming mode, it is controlled by a 16-bit register which determines which record will



output to DO2. On the panel, it is set as decimal but in the register it is binary, so it needs conversion.

36, 37: The same as DO1 and DO2.

38: Two alarm rules can be logically “and” by controlling the logic switch. When two alarm rules are logical and the alarming works, only both of them are true. This function is controlled by the low 8 bits of a 16-bit register; each bit is corresponding to a group. “1” means this function is turned on and “0” means off.

39: Any change on DI can trigger waveform capturing. It is controlled by a 16-bit register. Bit1, bit0 controls DI1, bit3, bit2 controls DI2, bit4, bit5 controls DI3 and bit7, bit6 controls DI4. “00” stands for no capturing, “01” capture from off to on, “10” from on to off and “11” for any changes.

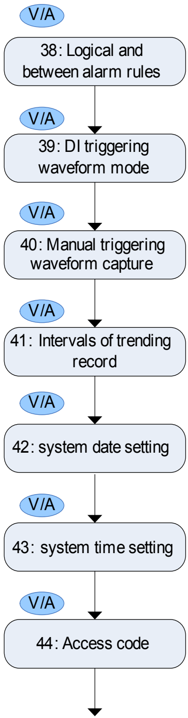
Note: You should convert the hex number to a binary number first.

40: Under the condition of a blank record, setting “yes” can initialize one record of the waveform capture.

41: After every interval, it records the value of frequency, UA (UAB), IA, UB (UBC), IB, UC (UCA), IC. The values are called trending records. The interval can be set from 1min - 60min with a default of 60min.

42: Display format is MM: DD: YYYY.

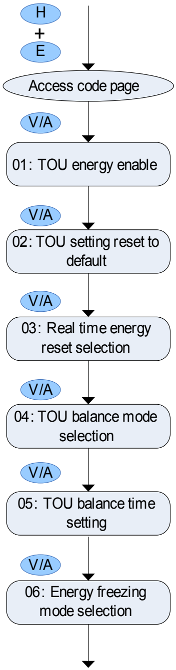
43: display format is hh:mm:ss.



44: This is the last screen of the setting page. The access code can be changed on this page. It is important to remember the new access code.

Energy Parameter setting

Pressing H and E simultaneously under the metering data display mode will enter the energy settings page. The key operation is the same as in other setting pages. You need to press H and E simultaneously to exit this mode.



The following table shows you how to set it:

01: TOU can be forbidden in application.

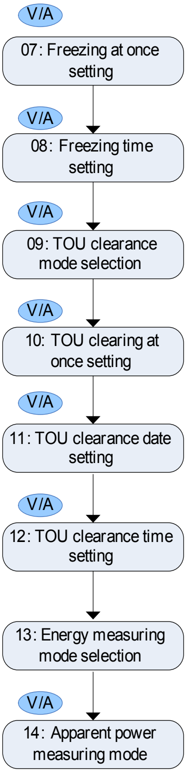
02: TOU time setting is complex, the meter has a default when it leaves the factory. You can use the default or set it yourself.

03: Energy can be reset by writing registers one by one or writing “0” to them all at one time. TOU and real time energy can be reset respectively.

04:“nature” means balance at the end of a month, “assign” means balance at an assigned time every month. TOU balance means to end the accumulation of the energy in the current balance month and begin to accumulate the energy in a new balance month.

05: When “assign” is selected, the time is to be set here, format is dd:hh:mm:ss.

06: Copy the real time energy and TOU energy of current month to the freezing memory. There are two modes. “Assign” means pointing a time to freeze, “at once” means freezing right now. If you select the “assign” mode, you need to set the time on the 8th screen skipping the 7th; if you select the “at once” mode, you need to finish the 7th screen in order to execute the order.



07: This screen will display only when you select the “at once”.

08: Set your time of freezing on this screen when you select the “assign” mode.

09: There are two modes of clearance: “assign” means clear at an assigned time, this will skip the 10th screen to the 11th to set the time. “At once” means clear at once after you finish the 10th screen.

10: Finish this screen when you select the “at once” mode.

11: Execute this order every year at this date:MM:DD.

12: Execute this order every year at this time:hh:mm:ss.

13: “0”stands for fundamental based measuring, “1” stands for all-wave based measuring.

14: “0” stands for mode 0: $S = \sqrt{P^2 + Q^2}$

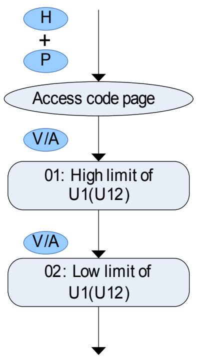
“1” stands for mode 1: $S = \sqrt{P^2 + Q^2 + D^2}$.

Voltage Eligibility Parameter Setting

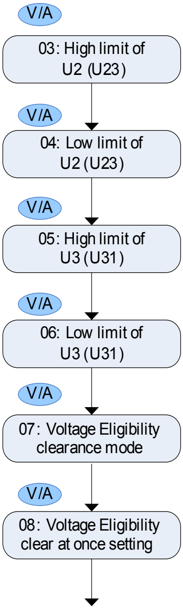
Pressing H and P simultaneously under the metering data display mode will enter the voltage eligibility statistics setting page. The operation of keys is the same as in other setting pages. You need to press H and P simultaneously to exit this mode.

Whether the voltage is eligible or not is according to whether the measured voltage is within the limitations set by the user. The limitations of the three phase voltages can be set respectively and the setting value is the same as the communication value, which is the secondary value without PT and CT.

The following table shows you how to set it:



01, 02: When the meter is set to “2LL”, it is U12 and U1 for others.

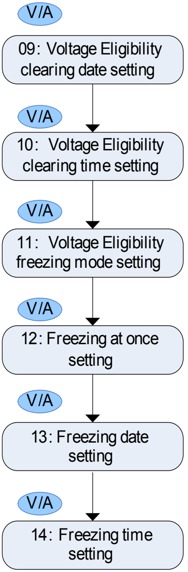


03, 04: when the meter is set to “2LL”, it is U23 and U2 for others.

05, 06: when the meter is set to “2LL”, it is U31 and U3 for others.

07: There are two modes of clearance: “assign” means clear at an assigned time, this will skip the 8th screen to the 9th to set the time. “At once” means clear at once after you finish the 8th screen. After the clearance, all time values will be 0 and voltage eligibility will be 100%.

08: Finish this page when you select the “at once” mode.



09, 10: Set the time for the “assign” mode.

11: It only freezes real time measurement. There are two modes. “Assign” means pointing a time to freeze, “at once” means freezing right now. If you select the “assign” mode, you need to set the time on the 13th screen skipping the 12th; If you select the “at once’ mode, you need to finish the 12th screen in order to execute the order.

12: if you select the “At once” mode at the “Voltage Eligibility freezing mode setting”, you can go into this page to execute the order at once.

13, 14: The meter will freeze the data at this

moment according to its inner clock.

Chapter 4 Function and Software

Functionality and Utility Software

The DPMS XPQ can measure almost all the parameters in the power system. Some of its functions may not be demonstrated by simply pressing the keys, hence, the software to go with it. We'll introduce functions with the help of the software interface in this chapter. The version of the software you buy may be advanced and it may differ somewhere, please refer to the manual that goes with it.

Basic Analog Measurements

It can measure voltage, current, power, frequency etc with high accuracy, shown as below:

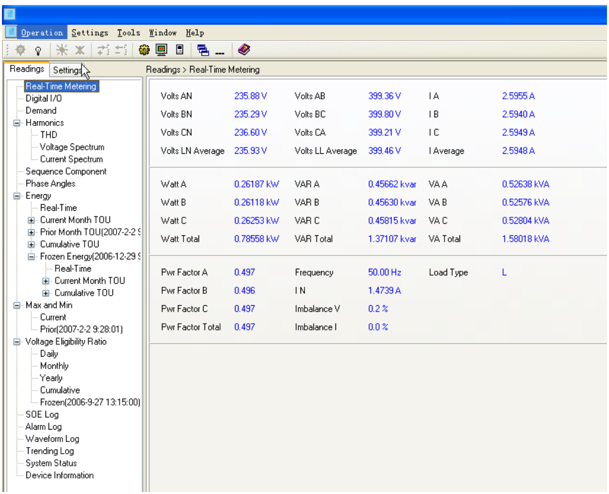


Fig 4.1 Real-Time Metering

Note1: It should be clear that there is a defined correspondence between the real value and communication value. For more detail, please refer to chapter 5.

Note 2: Settings related to measurements are in system settings.

Harmonics

It can measure and analyze THD, Harmonics (2nd to 31st), even HD, odd HD, Crest Factor, THFF, K factor etc. Values excluding harmonic ratios are shown in the figure below:

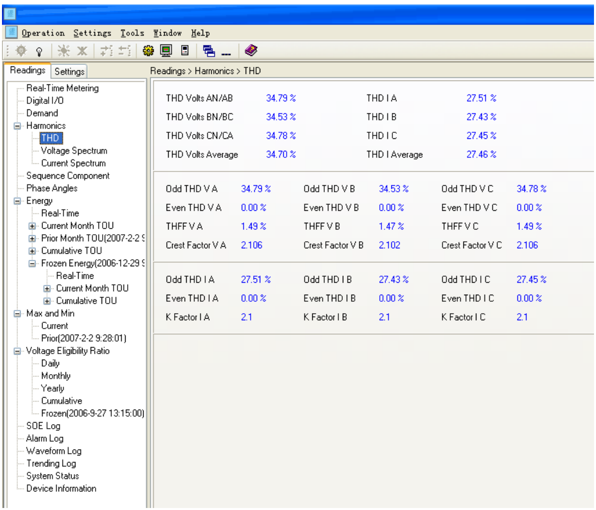


Fig 4.2 Total Harmonic Distortion

A chart in the software is shown below:

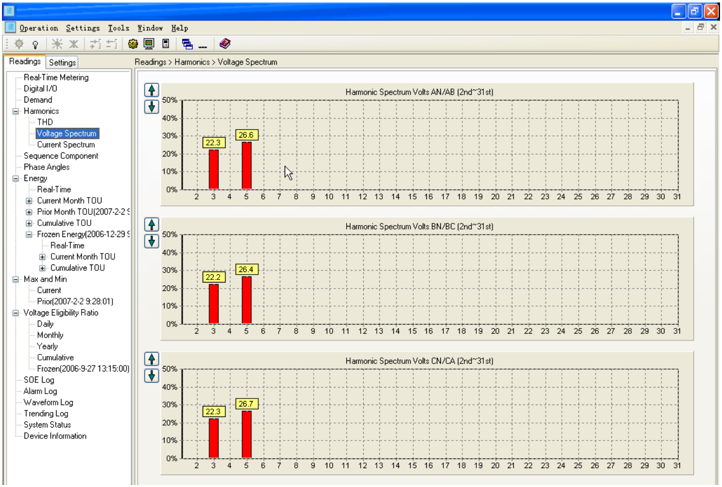


Fig 4.3 Voltage Spectrum

Phase angle

Phase angle indicates the angle between U1 and other voltage and current parameters. It ranges from 0 - 360 degrees. This function is to help you find out the relationship between all input signals avoiding incorrect wiring. When it is set to “2LL”, it gives the phase angle of u23, i1, i2, i3 corresponding to u12 and u2, u3, i1, i2, i3 corresponding to u1 for other settings.

The following figure is an example:

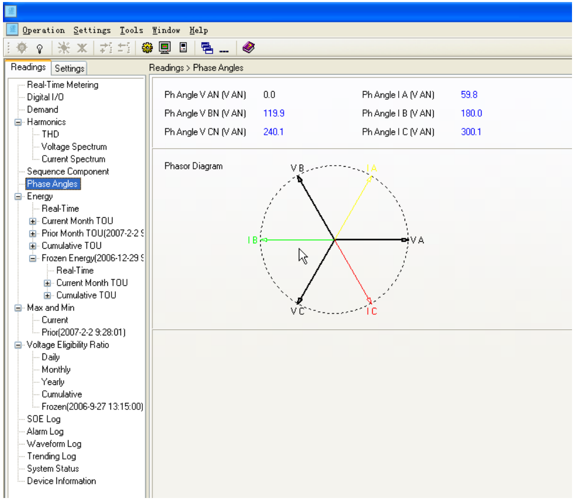


Fig 4.4 Phase Angles

Current direction adjustment

The right current direction is from port 1 to port 2. To adjust polarity of current, the three currents direction can be set as "Negative" which means reversing 180 degrees and "Positive" which means normal.

Sequence component and unbalance analysis

The DPMS XPQ will do some sequential analysis for the input signal. it makes out the positive sequence, negative sequence and zero sequence of the fundamentals and will do the unbalance analysis of voltage and current.

The following figure shows a sequence chart:

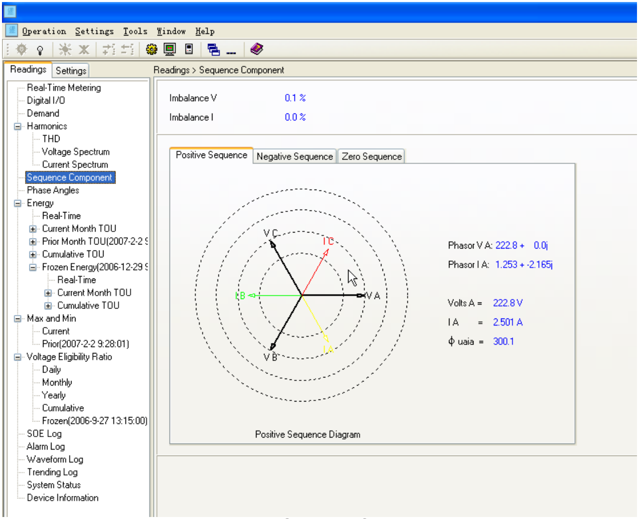


Fig 4.5 Sequence Component

Max/Min

The meter can record statistics of the maximum and minimum values of phase/line voltages, currents, power, reactive power, apparent power, power factor, frequency, demand, unbalance factor, THD as well as the time they occur. The statistic period can be set as “month” or “day”. All the data will be stored in nonvolatile memory so that they will not be lost when the power is off. All the data can be accessed via communication port and be cleared by panel keys.

The following figure is an example:

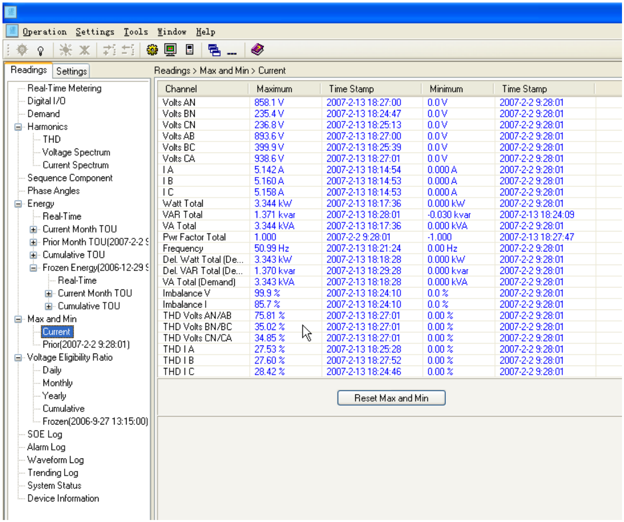


Fig 4.6 Max and Min

Demand

Types of demands calculated are: consumption power demand of phases A, B, and C, generation power demand of phases A, B, and C, absorption reactive power demand of phases A, B, and C, generation reactive power demand of phases A, B, and C, consumption power demand of three phase, generation power demand of three phase, absorption reactive power demand of three phase, generation reactive power demand of three phase, apparent

power demand, current demand of I1, current demand of I2, current demand of I3, current demand of average current, consumption power predictive demand, generation power predictive demand, absorption reactive power predictive demand, generation reactive power predictive demand, and apparent power predictive demand.

The values calculated include last period values, current period values, peak demands and their occurring time. Current period values are the calculation values of demand in the current period, while last period values refer to the values achieved for the last completed period. Peak demands are the maximum demands since cleared last time. Time stamp will be stored when the update of the calculation occurs.

Peak demand and demand memory can be cleared. To clear is to reset all the registers to 0, like the initial state of the meter (demand calculation only).

Demand calculating mode can be set as a sliding window, fixed window, rolling window or thermal demand according to the user.

In the sliding window interval, you select an interval from 1 - 60 minutes, which is the period of the calculation. The demand updates every minute.

In fixed window interval, select the period of the calculation as mentioned above. The meter calculates and updates the demand at the end of each period.

In rolling window interval, you select an interval and a subinterval. The subinterval should divide exactly by the interval. Demands update at the end of each subinterval.

Thermal demand method calculates the demand based on a thermal response which mimics the thermal demand meter. You select the period for the

calculation and the demands update at the end of each period.

Synchronization demand

When it is set as a fixed window, rolling window or thermal demand, the period can be synchronized via communication port or by changes of DI.

DI Synchronization demand

Changes to DI can trigger the synchronization of the demand period. The set is as follows.

1. Select a method from fixed window, rolling window or thermal demand.
2. Select a DI port (address is 1040H) as the trigger, the values are 0~4 corresponding to none and D1~D4.
3. Select the trigger mode of DI (address is 1041H), the values are 1~3 corresponding to from OFF to ON, from ON to OFF, triggering at any change.

Command Synchronization demand

Using a broadcast command to synchronize the demand, calculation can be set as follows:

1. Select a method from fixed window, rolling window or thermal demand.
2. Broadcast command: the addresses of all the meters are considered 0. Write ff00H to address 8000H using the 10H command. But the receiver may not answer.

Note: All operations can only be finished via communication. Using key functions can only partially finish them.

Here is an example:

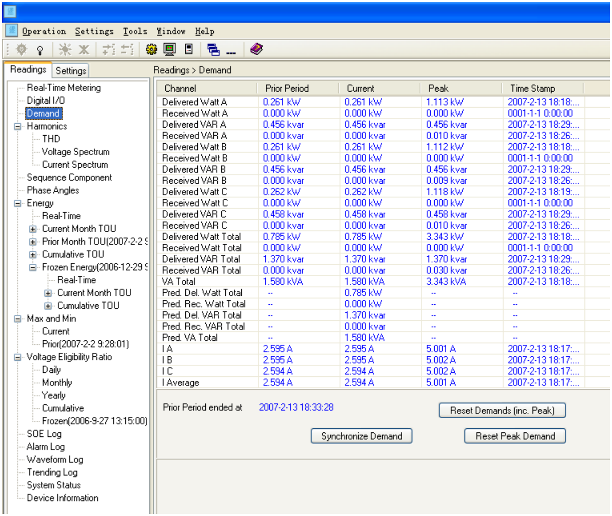


Fig 4.7 Demand

Here is to set demand:

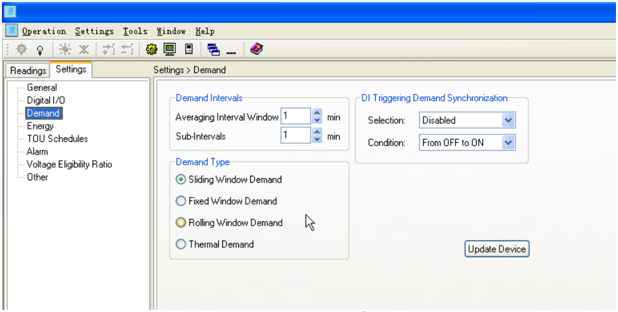


Fig 4.8 Demand Setting

Energy

Various kinds of energy will be accumulated. The settings are explained in other chapters, so please refer to chapter 3 and chapter 5 carefully.

Real time energy: the accumulation of energy for the kWh, kVARh and kVAh since cleared last time.

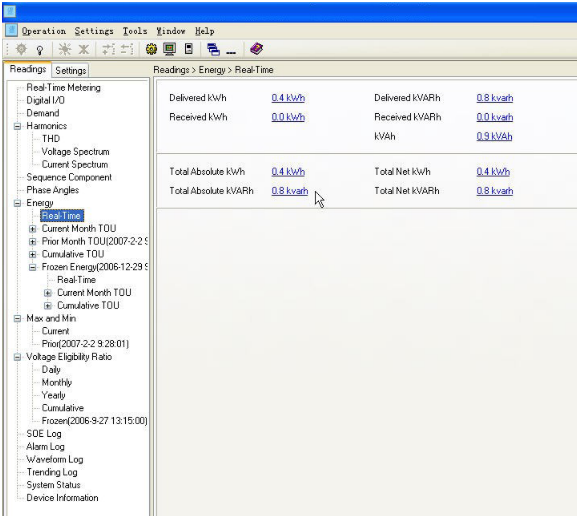


Fig 4.9 Real-Time Energy

TOU

You can point some different time block to go with different rates (sharp, peak, valley and normal). The meter will calculate the fee according to its inner clock and the settings. So it charges different fees for different rates.

The following is an example:

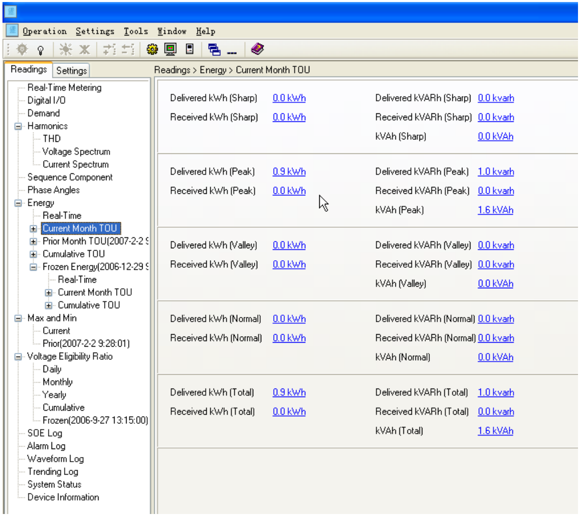


Fig 4.10 Current Month TOU

Calculating mode

1. You can select calculating mode from a fundamental base or all-wave base by pressing a key or via communication. Fundamental based calculating is to accumulate energy ignoring harmonics while all-wave based calculating is to accumulate energy including fundamental and harmonics.

2. There are two ways to calculate apparent energy(power):

Mode 0: $S = \sqrt{P^2 + Q^2}$

Mode 1: $S = \sqrt{P^2 + Q^2 + D^2}$

The following figure shows how to set it:

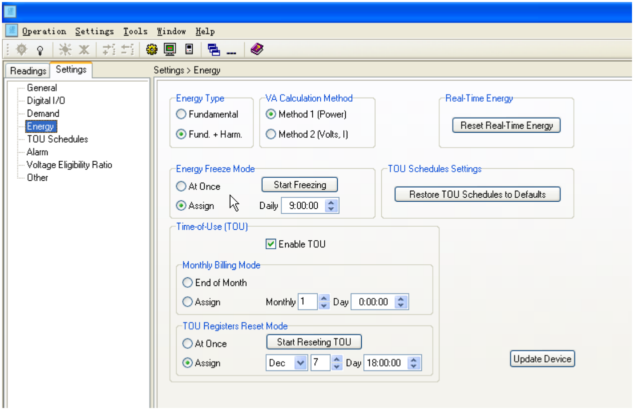


Fig 4.11 Energy Setting

Freezing

This is to backup the accumulated TOU, current TOU, and real time energy at some time point without affecting the existing data.

You can use the freeze data for the statistic applications, with all the values recorded at the same time, enhance the accuracy and efficiency. Freezing can be set automatically or manually making the application very flexible.

Here is an example:

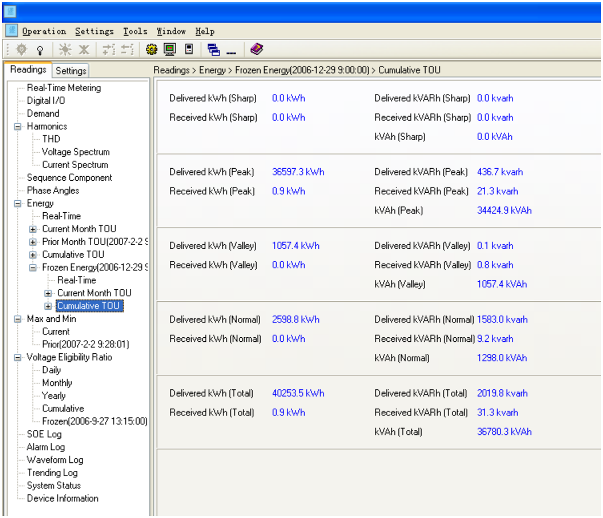


Fig 4.12 Cumulative TOU

TOU calendar:

There are four schedules and each schedule has 8 time intervals. Each interval can charge one of the four rates: sharp, peak, valley and normal.

Time format for each schedule is: enable | start time mm:dd:hh:mm:ss | end time mm:dd:hh:mm:ss

Time format for each interval is: enable | start time hh:mm:ss | end time hh:mm:ss | rate kind

You can adjust the calendar to satisfy different uses. To ensure the validity of the calendar setting, the meter will check its rationality strictly. If there is no mistake in the calendar and the TOU function is enabled, TOU accumulation will begin.

Requirement of the time format:

1. Schedules must be selected in turn. For example, if you use two schedules, you should enable the first and then the second.

2. The sum of all schedules must be one year. For example, if you only use schedules, the first is from January 1st 03:03:03 to July 6th 02:02:02, the second period must be from July 6th 02:02:02 to January 1st 03:03:03.

3. Start time of the next schedule must be the end time of the last schedule.

4. Schedules in use must be at least 1 and at most 4.

5. The record in use must be at least 1 and most 8 used in turn. If you use 3 intervals, you should use the 1st, 2nd and 3rd.

6. The sum of all time intervals in a schedule must be one day. For example, 3 intervals are enabled, if the first interval is from 03:03:03 to 12:02:02, the second interval is from 12:02:02 to 02:03:03, then the third interval must be from 02:03:03 to 03:03:03.

7. The next start time equals the last end time.

8. Many intervals can share the same rate.

Note: You can order special factory settings, the product has default settings. You can reset the meter to default via communication or by key functions.

Here is an example:

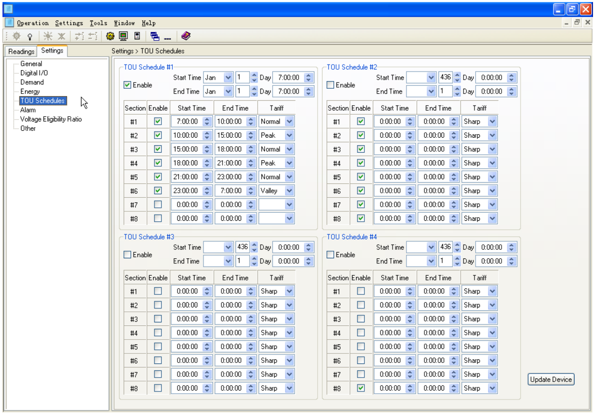


Fig 4.13 TOU Schedules Setting

Pulse Energy Output

The two digital outputs can be used as energy pulse output and cannot be used as the alarming outputs at the same time. The output energy can be selected among all kinds of energy and reactive energy. Pulse constant and pulse width can be set to meet your requirements. Pulse constant is the kWh a pulse stands for, pulse width is the pulse duration. When the accumulated energy reaches the pulse constant, there will be a pulse on DO.

Related parameters: pulse energy output ranges from 0 to 4 corresponding to none, Ep_imp, Ep_exp, Eq_imp, Eq_exp.

Pulse constant ranges from 1 - 6000 (integer) with a unit of 0.1kWh (kVARh), apparently that is the resolving power of energy output.

Pulse width ranges from 1 - 50 (integer) with a unit of 20ms. The narrowest interval between two pulses is 20ms.

In practice the pulse width and the pulse ratio are selected according to system power. The relation of the two parameters should be satisfied by the following expression,

In the expression, the Pmax is the maximum power or reactive power. The unit is kW or kVAR. Recommend pulse ratio is 3 to 5 times the right side value

$$Pulse\ radio > \frac{(\ pulse\ width + 1\ ) \times Pmax}{18000000}$$

of the above expression.

The related settings are:

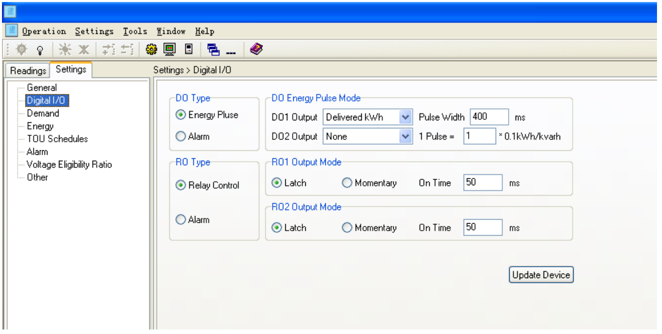


Fig 4.14 Digital I/O Setting

Event alarming

When the metering data is over the pre-setting limit and over pre-setting time interval, the over limit alarming will be picked up. The over limit value and time will be recorded and the maximum number of records is 16. The digital output (DO) and RO1, RO2 can be used as a trigger to light or sound alarming. Alarming can also trigger waveform capturing.

Application and settings of event alarming:

In order to use the event alarming function, you should finish all the settings (equation or in equation or enable switches) correctly, or it will fail. All the settings are to write their corresponding registers via communication.

1. Alarming setting

Table 4-1 indicates a group of settings, there are 16 groups in all with the same format. Parameter is the main body. There are 247 parameters in all as shown in table 4-2.

We use the serial number instead of its parameter to finish the settings, the serial number will be stored in the first storage unit of every group.

What is most important is parameter, so we can calculate some equations or in equations to get the goal. For example, if we want one event of frequency equaling to 50 Hz, we set: serial number: 0; comparison mode: 2; setting value: 5000.

Special attention: “setting value” corresponds to main parameter, the relationship between its value and real physical value is the same as the main parameter.

“Delay time” indicates the time period that the event keeps happening after the setting equation or in equation is satisfied, which is used to confirm the event. Its value ranges from 0 - 6000 (integer) with a unit of 10ms. There is no delay when it is set to be 0, so the event triggers alarming at once. For example, if it is set to be 20, delay is 20*10=200ms. “Waveform triggering” refers to whether waveform capture works when the set event occurs.

address	parameter	range
14F0H	First group: serial number	0~246
14F1H	First group: comparison mode	1:more,2:equal,3:less
14F2H	First group: setting value	Related with parameters
14F3H	First group: delay time	0~6000(*10ms)
14F4H	First group: waveform capture	1:capture; 0:not capture

Table 4-1 first group of alarming settings

Serial number	parameter
0~32	33 basic analog measurements parameters from“Frequency” to “Loadcharacteristic” discussed in chapter 5.
33~241	209 parameters from “THD_V1” to “K Factor of I3” discussed in chapter 5.
242	Consumption energy predict demand
243	Generation energy predict demand
244	Consumption reactive energy predict demand
245	Generation reactive energy predict demand
246	Apparent energy predict demand

Table 4-2 parameters for alarming

Thus far, the equations or in equations are finished, but the setting are not finished yet, we have to go through the following steps to finish them.

2. Global settings

The addresses of all global variables are 101dH~1024H and 103dH in system parameters discussed in chapter 5. "Alarming enable" determines whether the alarming function of this meter works. Only when it is set as "1", the alarming function enables. When "Alarming flash enable" is set to "1", the backlight will flash when an alarm happens.

"Alarming records enable setting" determines whether it records. There are 16 records in all and each one corresponds to one bit of a 16-bit register. For each record, it works or not depending on the enable setting. If some bits of the register are "1", it means their corresponding records take effect.

"Relay for alarming setting": There are two relays. They can be used as remote controlling output and alarming output. But one can't work in two modes at the same time. "1" means the relay works in alarming mode and "0" for remote controlling mode. This setting is valid for both relays.

"Alarming output to RO1 setting": when "Relay for alarming setting" is set to be "1", the relay is available for alarming, but which record it will be driven by and whether output to RO1 or RO2 will depend on other settings. This setting will give an answer. There are 16 records in all and each one corresponds to one bit of a 16-bit register, when the corresponding bit is set to "1", the relay will close if the alarming condition is satisfied. It opens only when all the alarms related to RO1 recover. If the corresponding bit is set to "0", RO1 will not be disturbed.

Note: When the relay is used in alarming mode, it works in latching mode. There is no pulse mode. So all setting of the relay's working mode will be ignored.

“Alarming output to RO2” decides which alarm will be output to RO2. It is set the same as RO1.

“Alarming output to DO1 setting”: When “Digital output mode” is set to “1”, DO1 can be used as an alarming output. Which alarm will be output to RO2 is set here. You need to do the same as what you do in setting RO1.

“Alarming output to DO2 setting”: The same as “Alarming output to DO1 setting”.

“Logical and between alarming setting”: The 16 alarming records are divided into 8 groups. Each group has two records. The two alarms can be logically “and” by controlling the logic switch. When two alarms are logically “and”, the alarming works only when both are satisfied. If the switch is off, the two alarms work independently.

The 8 groups are arranged as follows: according to their serial number, the 1st & 2nd make the 1st group as group A; the 3rd & 4th make the 2nd group as group B; The 5th & 6th make the 3rd group as group C; 7th & 8th make the 4th group as group D; 9rd &10th make the 5th group as group E; 11th & 12th make the 6th group as group F; 13th & 14th make the 7th group as group G; 15th & 16th make the 8th group as group H.

This function is controlled by the low 8 bits of a 16 bits register, each bit corresponds to a group. “1” means this function is turned on and “0” means off.

After finishing the previous settings, the alarming function is turned on. We’ll show you an example of how to use the logical “and” in a group.

We set an event as follow: I1 greater than 180A, delay 5s for the 1st record; U1 less than 9980V, delay 10s for the 2nd record. No waveform triggering,

no output. The CT primary value of I1 is 200A. The primary voltage of U1 is 10000V, PT2 is 100V. Then let's look how all the related registers are set.

The first record:

According to the table, the serial number of I1 is 9 ((14d8H)= 9); Conditions in equation 1 determine the high limit. So "comparison mode" (14d9H) = 1(>). CT1 is 200A, according to the relationship between the communication value and numerical value. I=Rx X(CT1/5)/1000, so I1 is 180A. Then the limit is (14daH) = 4500; Delay 5s, as the unit of Limit_t register is 10ms, so the delay time is (14dbH) = 500; Alarming but no waveform triggering, "waveform capture" (14dcH) = 0.

The second record:

According to the table, the serial number of U1 is 1 ((14ddH) = 1); Conditions in equation 1 determine the low limit. So "comparison mode" (14d9H) = 3(<); PT1 is 10000V, according to the relationship between the communication value and numerical value, U=Rx X (PT1 / PT2) /10, so the register value should be 998; Delay 10s, as the unit of Limit_t register is 10ms, so the delay time is (14e0H) = 1000; Alarming but no waveform triggering, so "waveform capture" (14e1H) = 0.

Settings between the two records:

"Alarming output" of the 1st, 2nd(101fH) = 0x0003; No hardware output, (1020H)=0; (1021H)=0;(1022H)=0; (1023H)=0; logical and(1024H)=0x0001; At last, the" alarming enable", (101dH) =1.

Here is a figture showing the alarming settings:

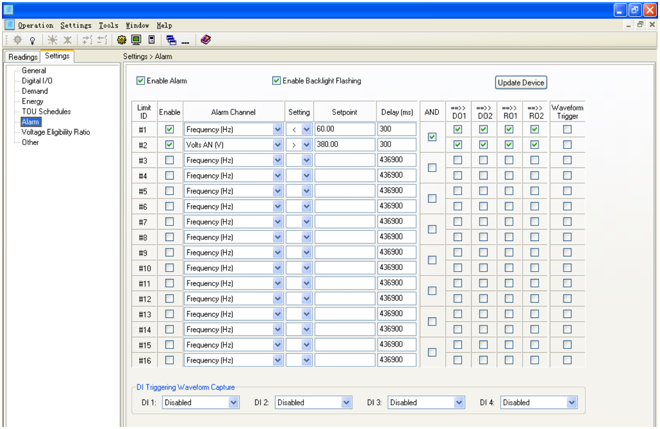


Fig 4.15 Alarm Setting

Event alarming setting

There are 16 of records to be stored. But they are not corresponding to setting records, they record in cycle. The latest event will cover the oldest one. It begins from the 1st record when the power is turned on. When over range parameters resume to normal, the time and value will be recorded as an event as well. So you can work out the continuous time of over range by checking the changing time.

Here is the 1st record. Other records have the same format.

address	parameter	range
1540H	First group: alarming status	0~65536
1541H	First group: parameter number	0~246
1542H	First group: over range or reset value	Related with parameters
1543H~1549H	First group: occur time: yyyy mm:dd:hh: mm:ss:ms	time

Table 4-3 alarming status of the 1st record

“alarming status” indicates information of the current status. It is a 16-bit unsigned integer. Serial number is stored in the high 8 bits. Bit1 indicates logical and.

Bit1=1,yes; Bit1=0,no. Bit0 indicates alarming is to setup or to recover. Bit0=1, setup; Bit0=0, recover. Undefined bits are 0.

“Serial number” indicates which parameter is recorded.

“Value” indicates alarming limit value.

“Time” indicates the time with accuracy of ms.

Alarming event will set bit2 of “system status” to 1. At the same time, corresponding flags will be set to 1 to indicate new data. It should be cleared after the controller has read the data, then bit2 of the system parameter will be set to 0.

Note: alarming records will not be lost during power off. The pointer will point to the 1st record after it is powered on again.

Here is an example:

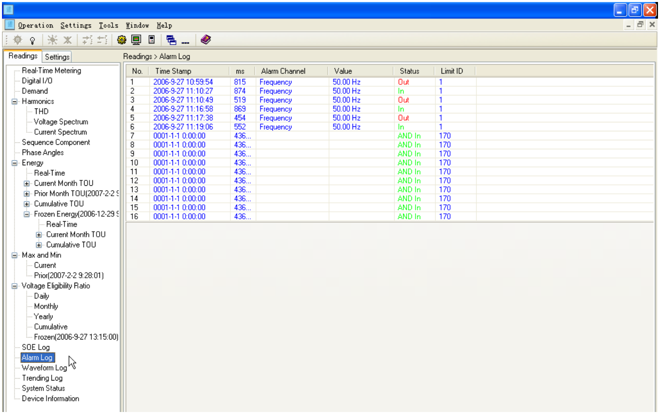


Fig 4.16 Alarm Log

SOE Function

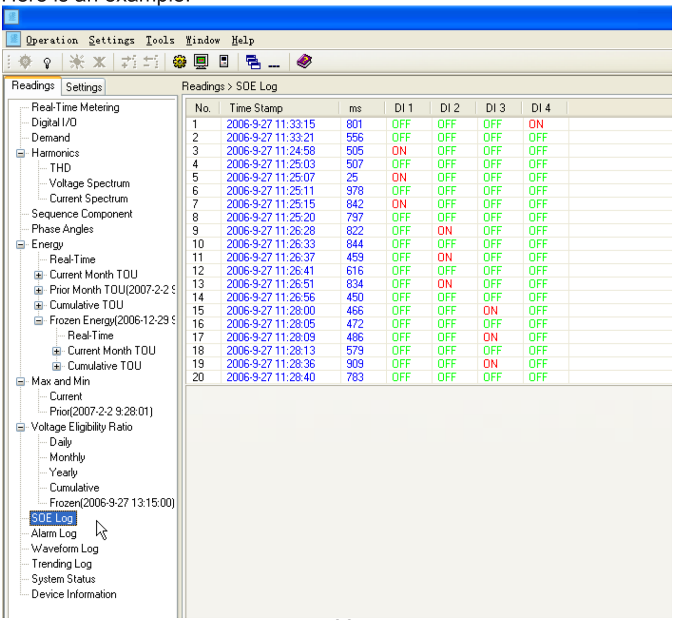
There are 4 DI inputs, it can record changing information of DIs. The time resolution is 1ms. It can also determine whether to enable waveform capture and which kind of triggering by setting “DI triggering waveform capture mode” in system parameters. Its register forms a 16-bit unsigned integer. Bit1,bit0=DI1; Bit3,bit2=DI2;Bit5,bit4=DI3; Bit7,bit6=DI4. “00” stands for none, “01” stands for from OFF to ON, “10” stands for from ON to OFF ,“11” stands for trigger at any change.

Format: DI status | occur time yyyy |mm | dd | hh | mm | ss | ms

There are 20 groups of records, it will begin with the first one after power

on and it works in a cycle. The data won't lose during power off SOE will set bit0 of "system status" to be 1. At the same time, corresponding flags will be set to 1 to indicate new data. The meter sets flag of SOE but does not clear it. It should be cleared after controller has read the data, then bit0 of system parameters will be set to 0.

Here is an example:



No.	Time Stamp	ms	DI 1	DI 2	DI 3	DI 4
1	2006-9-27 11:33:15	801	OFF	OFF	OFF	ON
2	2006-9-27 11:33:21	556	OFF	OFF	OFF	OFF
3	2006-9-27 11:24:58	505	ON	OFF	OFF	OFF
4	2006-9-27 11:25:03	507	OFF	OFF	OFF	OFF
5	2006-9-27 11:25:07	25	ON	OFF	OFF	OFF
6	2006-9-27 11:25:11	978	OFF	OFF	OFF	OFF
7	2006-9-27 11:25:15	842	ON	OFF	OFF	OFF
8	2006-9-27 11:25:20	797	OFF	OFF	OFF	OFF
9	2006-9-27 11:26:28	822	OFF	ON	OFF	OFF
10	2006-9-27 11:26:33	844	OFF	OFF	OFF	OFF
11	2006-9-27 11:26:37	459	OFF	ON	OFF	OFF
12	2006-9-27 11:26:41	616	OFF	OFF	OFF	OFF
13	2006-9-27 11:26:51	834	OFF	ON	OFF	OFF
14	2006-9-27 11:26:56	450	OFF	OFF	OFF	OFF
15	2006-9-27 11:28:00	466	OFF	OFF	ON	OFF
16	2006-9-27 11:28:05	472	OFF	OFF	OFF	OFF
17	2006-9-27 11:28:09	486	OFF	OFF	ON	OFF
18	2006-9-27 11:28:13	579	OFF	OFF	OFF	OFF
19	2006-9-27 11:28:36	909	OFF	OFF	ON	OFF
20	2006-9-27 11:28:40	783	OFF	OFF	OFF	OFF

Fig 4.17 SOE Log

Waveform record

The DPMS XPQ can record 5 cycles of waveforms both before and after the trigger point of the entire 6 input channels (U1, U2, U3, I1, I2 and I3). There are 16 points for each cycle and a maximum of 5 waveform records.

There are three reasons for waveform triggering: DI changes, alarming and manual triggering. Please refer to related chapters for more details.

Format: w1~w7 recording time (w1:yyyy; w2:mm; w3:dd; w4:hh; w5:mm; w6:ss; w7:ms).

w8-w10 indicates the trigger: (w8: DI triggering, Bit1,bit0 indicates DI1; Bit3,bit2 indicates DI2; Bit5,bit4 indicates DI3 and Bit7,bit6 indicates DI4. "00" indicates not trigger by DI, "01" indicates trigger by DI from off to on, "10" indicates trigger by DI from on to off and "11" indicates a trigger by DI for any changes. w9: alarming trigger, bit0~bit15 are corresponding to the 1st - 16th of the 16 alarming groups. 1: alarming trigger capture; 0: alarming does not trigger capture. w10: manual triggering.1:yes; 0:no.)

Then there are 10 cycle waveform of UA, 10 cycle waveform of IA, 10 cycle waveform of UB, 10 cycle waveform of IB, 10 cycle waveform of UC, 10 cycle waveform of IC. Please refer to the address table for more details.

The waveform record will set bit1 of "system status" to 1. At the same time, corresponding flags will be set to 1 to indicate new data. The meter sets the flag of the waveform record but does not clear it. It should be cleared after the controller has read the data, then bit0 of system parameters will be set to 0.

Update rule: It checks out empty records from the first one, if there is no blank record, it won't take a new record. All records won't be lost during power off.

Here is an example:

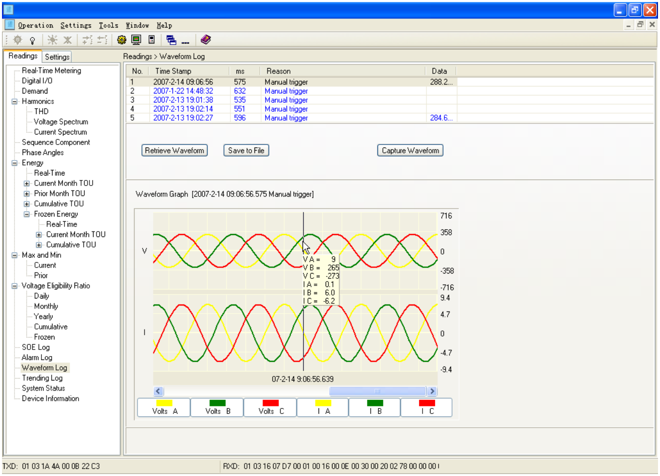


Fig 4.18 Waveform Log

Trending records

The DPMS XPQ-G takes records of frequency, UA (or UAB), IA, UB (or UBC), IB, UC(or UCA), IC at a fixed interval. So the controller can draw trending charts easily.

The time interval can be 1~60 minutes, with the default of 60.

It can take 336 records in all and recurs after it is full. It takes the occurring time of the latest record and there are no time stamps for other records. “Trending record pointer” indicates the serial number of the next record. This pointer can

not be changed. "Trending record backup pointer" is used by the controller, it stores the serial number that the controller will read, it can not be changed by the meter either. It is used to compare "trending record pointer" with input data from the controller, when the two are equal, bit4 of "system status" will be cleared ensuring all data has been read by the controller.

Bit4 of "system status" will be set to 1 when there is a new record.

Trending records will not be lost during power off. "Trending record pointer", "trending record backup pointer" and Bit4 of "system status" will be set to 0 after power on.

Here is an example:

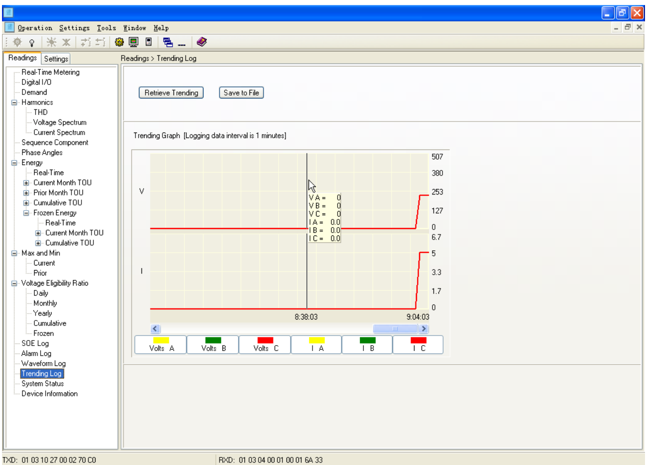


Fig 4.19 Trending Log

Voltage Eligibility

The DPMS XPQ-G can take the statistics of voltage eligibility, then give out a great amount of data.

Eligibility = (1-overlimit time/Measuring time)*100%

The upper and lower limits of voltage can be set according to the user. When voltage is out of range, it is not eligible. Three limitations of voltages of the phase or line can be set respectively. The format of the setting value and communication value is the same. They are all set according to input voltages. For example, if the PT used is a 10000/100 PT, the high limit of voltage is set as 10300V, then the setting value is 10300÷(10000/100)=103V. Then according to the relationship between the communication value and numerical value , U=Rx X (PT1 / PT2) /10, so the value to be written, Rx is 103*10=1030. Setting by pressing keys should use the same value.

Voltage eligibility consists of running time, channel eligibility and eligible time. In order to find and analyze, it is divided into real time, statistics, and freezing zone. Please refer to the address table for more details. The format of eligibility is 99.9999999%.

Voltage eligibility can be frozen and cleared.

Here is an example:

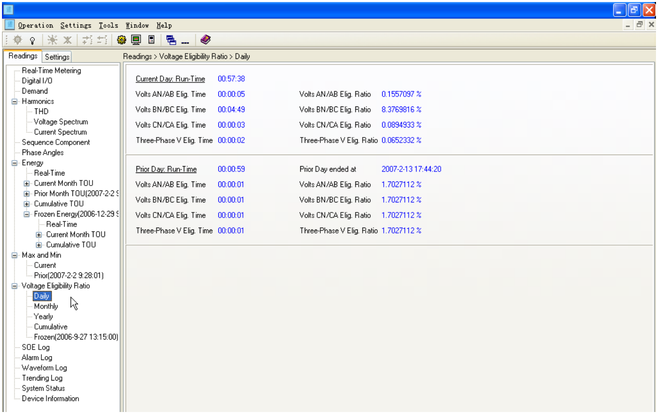


Fig 4.20 Voltage Eligibility Ratio

Chapter 5 Communication

Introducing Modbus Protocol

Format of Communication

Data Address Table

Application Details

This chapter mainly discusses how to handle the meter via the communication port using software. To master this chapter, you should be familiar with Modbus and have read the other chapters in this manual. Once you have completed these steps you will have mastered the function and application of this product.

This chapter includes: Modbus protocol, the format of communication and data address tables and application details.

Introducing Modbus Protocol

The Modbus RTU protocol is used for communication in the DPMS XPQ. The data format and error check methods are defined in the Modbus protocol. The half duplex query and respond mode is adopted in the Modbus protocol. There is only one master device in the communication net. The others are slave devices, waiting for the query of the master.

Transmission mode

The mode of transmission defines the data structure within a frame and the rules used to transmit data. The mode is defined in the following which is compatible with Modbus RTU Mode*.

Coding System	8-bit binary
Start bit	1
Data bits	8
Parity	no parity
Stop bit	1
Error checking	CRC check

* Modbus is trademark of Modicon, Inc.

Framing

Address	Function	Data	Check
8-Bits	8-Bits	N×8-Bits	16-Bits

Table5.1 Data Frame Format

Address Field

The address field of a message frame contains eight bits. Valid slave device addresses are 0~247 decimal. A master addresses a slave by placing the slave address in the address field of the message. When the slave sends its response, it places its own address in this address field of the response to let the master know which slave is responding.

Function Field

The function code field of a message frame contains eight bits. Valid codes are 1~255 decimal. When a message is sent from a master to a slave device the function code field tells the slave what kind of action to perform.

Code	Meaning	Action
01	Read Relay Output Status	Obtain current status of Relay Output
02	Read Digital Input(DI) Status	Obtain current status of Digital Input
03	Read Data Obtain current	binary value in one or more registers
05	Control Relay Output	Force Relay to a state of on or off
16	Press Multiple-Register	Place specific binary values into a series of consecutive Multiple-Registers

Table5.2 Function Code

Data Field

The data field is constructed using sets of two hexadecimal digits, from 00 to FF hexadecimal. The data field of messages sent from a master to slave devices contains additional information which the slave must use to take the action defined by the function code. This can include items like discrete and

register addresses, the quantity of items to be handled, and the count of actual data bytes in the field. For example, if the master requests a slave to read a group of holding registers (function code 03), the data field specifies the starting register and how many registers are to be read. If the master writes to a group of registers in the slave (function code 10 hexadecimal), the data field specifies the starting register, how many registers to write, the count of data bytes to follow in the data field, and the data to be written into the registers.

If no error occurs, the data field of a response from a slave to a master contains the data requested. If an error occurs, the field contains an exception code that the master application can use to determine the next action to be taken. The data field can be nonexistent (of zero length) in certain kinds of messages.

Error Check Field

Messages include an error checking field that is based on a Cyclical Redundancy Check (CRC) method. The CRC field checks the contents of the entire message. It is applied regardless of any parity check method used for the individual characters of the message. The CRC field is two bytes, containing a 16 bit binary value. The CRC value is calculated by the transmitting device, which appends the CRC to the message.

The receiving device recalculates a CRC during receipt of the message, and compares the calculated value to the actual value it received in the CRC field. If the two values are not equal, an error will result. The CRC is started by 66 first preloading a 16-bit register to all 1’s. Then a process begins of applying successive 8-bit bytes of the message to the current contents of the register. Only the eight bits of data in each character are used for generating

the CRC. Start and stop bits, and the parity bit, do not apply to the CRC. During generation of the CRC, each 8-bit character is exclusive ORed with the register contents. Then the result is shifted in the direction of the least significant bit (LSB), with a zero filled into the most significant bit (MSB) position. The LSB is extracted and examined. If the LSB was a 1, the register is then exclusive ORed with a preset, fixed value. If the LSB was a 0, no exclusive OR takes place. This process is repeated until eight shifts have been performed. After the last (eighth) shift, the next 8-bit byte is exclusive ORed with the register current value, and the process repeats for eight more shifts as described above. The final contents of the register, after all the bytes of the message have been applied, is the CRC value. When the CRC is appended to the message, the low-order byte is appended first, followed by the high-order byte.

Format of communication

Explanation of frame

Addr	Fun	Data start reg hi	Data start reg lo	Data #of regs hi	Data #of regs lo	CRC 16 Hi	CRC 16 Lo
06H	03H	00H	00H	00H	21H	84H	65H

Table 5.3 Explanation of frame

In table 5.3, the meaning of each abbreviated word is,

Addr: address of slave device

Fun: function code

Data start reg hi: start register address high byte

Data start reg lo: start register address low byte

Data #of reg hi: number of register high byte

Data #of reg lo: number of register low byte

CRC16 Hi: CRC high byte

CRC16 Lo: CRC low byte

1. Read Status of Relay (Function Code 01)

This function code is used to read status.

1=On, 0=Off;

There are 2 Relays. The Address of each Relay is Relay1=0000H and Relay2=0001H.

The following query is to read Relay Status of meter number 17.

Query

Addr	Fun	relay start reg hi	relay start reg lo	relay #of regs hi	relay #of regs lo	CRC 16 Hi	CRC 16 Lo
11H	01H	00H	00H	00H	02H	BFH	5BH

Table 5.4 Read the status of Relay1 and Relay2 Query Message

Response

The DPMS XPQ response includes the meter's address, function code, quantity of data byte, the data, and error checking. An example response to read the status of Relay1 and Relay2 is shown in Table 4.5. The status of Relay1 and Relay2 is responding to the last 2 bits of the data.

Relay1: bit0; Relay2: bit1

Address	Function code	Byte count	Data	CRC high	CRC low
11H	01H	01H	02H	D4H	89H

Table 5.5 Relay status responds

The content of the data is:

7	6	5	4	3	2	1	0
0	0	0	0	0	0	1	0

MSB LSB

Relay1 = OFF (LSB), Relay2=ON (Left to LSB)

2. Read the Status of DI (Function Code 02)

1=On, 0=Off.

There are 4 DIs. The Address of each DI is DI1=0000H, DI2=0001H, DI3=0002H and DI4=0003H.

The following query is to read the 4 DI Status of Number 17 DPMS XPQ.

Query

Addr	Fun	DI start addr hi	DI start addr lo	DI num hi	DI num lo	CRC 16 Hi	CRC 16 Lo
11H	02H	00H	00H	00H	04H	7BH	59H

Table 5.6 Read 4 DIs Query Message

Response

The meter response includes its address, function code, quantity of data characters, the data characters, and error checking. An example response to read the status of 4 DIs is shown as Table 5.7. The status of each is responding to the last 4 bit of the data.

DI1: bit0 DI2: bit1 DI3: bit2 DI4: bit3

Address	Function code	Byte count	Data	CRC high	CRC low
11H	02H	01H	03H	E5H	49H

Table 5.7 Read Status of DI

The content of the data is,

7	6	5	4	3	2	1	0
0	0	0	0	0	0	1	1

MSB LSB

DI1=On, DI2=On, DI3=Off, DI4=Off

3. Read Data (Function Code 03)

Query

This function allows the master to obtain the measurement results of the meter.Table 5.8 is an example to read the 3 measured data (F, V1 and V2) from slave device number 17, the data address of F is 0130H, V1 is 0131H and V2 is 0132H.

Addr	Fun	Data start addr hi	Data start addr lo	Data #of regs hi	Data #of regs lo	CRC 16 regs Hi	CRC 16 regs Lo
11H	03H	01H	30H	00H	03H	06H	A8H

Table 5.8 Read F, V1, V2 Query Message

Response

The meter's response includes its address, function code, quantity of data byte, data, and error checking. An example response to read F, V1 and V2 (F=1388H (50.00Hz), V1=03E7H (99.9V), V2=03E9H (100.1V) is shown in Table 4.9.

Addr	Fun	Byte count	Data1 hi	Data1 Lo	Data2 hi	Data2 Lo	Data3 hi	Data3 Lo	CRC16 hi	CRC16 lo
11H	03H	06H	13H	88H	03H	E7H	03H	E9H	7FH	04H

Table 5.9 Read F, V1 and V2 Message

4. Control Relay (Function Code 05)

Query

This message forces a single Relay either on or off. Any Relay that exists within the meter can be forced to be either status (on or off). The address of Relays starts at 0000H (Relay1=0000H, Relay2=0001H). The data value FF00H will set the relay on and the value 0000H will turn it off; all other values are illegal and will not affect that relay.

The example below is a request to meter number 17 to turn on Relay1.

Addr	Fun	DO addr hi	DO addr lo	Value hi	Value lo	CRC 16 Hi	CRC 16 Lo
11H	05H	00H	00H	FFH	00H	8EH	AAH

Table5.10 Control Relay Query Message

Response

The normal response to the command request is to retransmit the message as received after the relay status has been altered.

Addr	Fun	Relay addr hi	Relay addr lo	Value hi	Value lo	CRC Hi	CRC Lo
11H	05H	00H	00H	FFH	00H	8EH	AAH

Table5.11 Control Relay Response Message

5. Preset / Reset Multi-Register (Function Code 16)

Query

Function 16 allows the user to modify the contents of a Multi-Register. Any Register that exists within the meter can have its contents changed by this message. The example below is a request to number 17 to Preset Ep_imp=(17807783.3KWH), while its Hex Value 0A9D4089H. Ep_imp data address is 0156H and 0157H.

Addr	Fun	Data start register hi	Data start register lo	Data register hi	Data register lo	Byte count	Value high	Value lo	Value hi	Value lo	CRC hi	CRC lo
11H	10H	01H	56H	00H	02H	04H	0AH	9DH	40H	89H	4DH	B9H

Table5.12 Preset KWH Query Message

Response

The normal response to a preset Multi-Register request includes the meter's address, function code, data start register, the number of registers, and error checking.

Addr	fun	Data start addr hi	Data start addr lo	Data register hi	Data register lo	CRC high	CRC low
11H	10H	01H	56H	00H	02H	A2H	B4H

Table5.13 Preset Multi-Registers Response Message

Data Address Table and Application Details

There are several rules to follow in using the meter:

1. Data type:

"bit" refers to binary

"word" refers to 16-bit unsigned integer using one data address and 2 bytes of memory, it varies from 0 - 65535.

"int" refers to 16-bit integer using one data address and 2 bytes of memory, it varies from -32768 - 32767.

"dword" refers to 32-bit unsigned integer using two data addresses and 4 bytes of memory with high word at the front and low word at the end, it varies from 0 - 4294967295.Rx=high word *65536+low word.

"float" refers to 32-bit single value using two data addresses and 4 bytes of memory, it varies from -1.175494E-38 - 3.402823E+38.

2. Relationship between communication value and numerical value.

The numerical value may not be the communication value, it is important to notice this. The following table shows how they correspond to each other.

parameters	relationship	unit	Format code
System parameters	Numerical value equals to communication value	No unit	F1
Run time	T=Rx/100	Hour	F2
Clock	Numerical value equals to communication value	Unit of time	F3
Energy	Ep=Rx/10	kWh	F4
Reactive energy	Eq=Rx/10	kVARh	F5
Apparent energy	Es=Rx/10	KVA	F6
Voltage	U=Rx X (PT1 / PT2) /10	V	F7
Current demand	I=Rx X(CT1/5) /1000	A	F8
Power demand	P=Rx X (PT1 / PT2) X (CT1/5)	W	F9
Reactive power demand	Q=Rx X (PT1 / PT2) X(CT1/5)	var	F10
Apparent power demand	S=Rx X (PT1 / PT2) X (CT1/5)	VA	F11
Power factor	PF =Rx / 1000	No unit	F12
Frequency	F=Rx / 100	Hz	F13
Unbalance factor	Unbl=(Rx/1000)X100%	No unit	F14
THD	THD=Rx / 10000 X 100%	No unit	F15
Harmonics	HDn=Rx / 10000 X 100%	No unit	F16
Total even HD	HDo=Rx / 10000 X 100%	No unit	F17
Total odd HD	HDe=Rx / 10000 X 100%	No unit	F18
Crest factor	CF =Rx / 10000	No unit	F19
K factor	KF =Rx / 10	No unit	F20
THFF	THFF= Rx / 10000 X 100%	No unit	F21
Phase angle Phase	angle=Rx/10	Degree	F22
Voltage Eligibility	Eligibility=(Rx /1000000000)X100%	No unit	F23
Time of Voltage Eligibility	Number after the dot	ms	F24

System Parameter Setting

System parameters determine how the meter works. You should understand it clearly by referring to chapters 3 and 4.

Function code: 03H for Reading, 10H for Presetting, data type: word. Format code: F1.

Address	Parameter	Default	Range
1000H	Access Code	0	0~9999
1001H	Communication Address	1	1~247
1002H	Baud Rate	19200	600~38400
1003H	Voltage Input Wiring Type	0	0:3LN, 1:2LN, 2:2LL
1004H	Current Input Wiring Type	0	0:3CT, 1:1CT, 2:2CT
1005H	PT1 (High 16 bit)	0	500~5000000
1006H	PT1 (Low 16 bit)	380	
1007H	PT2	380	500~4000
1008H	CT1	5	5~50000
1009H	DO type	0	0:Pulse Output 1:Alarm Output
100AH	Energy Variable Number associated with DO1	0	0~8
100BH	Energy Variable Number associated with DO2	0	0~8
100CH	Pulse Width	1	1~50
100DH	Pulse Rate	1	1~6000
100EH	Relay1 Working Mode	1	0: Latch 1: Momentary
100FH	Relay1 Pulse Width	200	50~3000
1010H	Relay2 Working Mode	1	0: Latch 1: Momentary

1011H	Relay2 Pulse Width	200	50~3000
1012H	LCD Back light Time	1	0~120
1013H	Demand Slid Window Time	15	1~60
1014H	Max/Min Clean	oah	Only 0ah works
1015H	Max/min statistics time	0	0:month,1:day
1016H	Clear demand memory	1	Only 1 works
1017H	Clear demand peak	1	Only 1 works
1018H	Demand calculating mode	1	1: sliding window, 2: fixed window, 4: rolling window, 8: thermal demand
1019H	Demand secondary period	5	1~60
101AH	Current I1 direction	0	0: Positive 1: Negative
101BH	Current I2 direction	0	0: Positive 1: Negative
101CH	Current I3 direction	0	0: Positive 1: Negative
101DH	Alarming enable	0	Only 1 works
101EH	Use of relay	0	1: alarming 0: remote control
101FH	Alarming records enable	0	0~65536
1020H	Alarming output to DO1	0	0~65536
1021H	Alarming output to DO2	0	0~65536
1022H	Alarming output to RO1	0	0~65536
1023H	Alarming output to RO2	0	0~65536
1024H	Logic and between alarming	0	0~255
1025H	DI triggering waveform capture mode	0	0~255
1026H	Manual triggering waveform capture	0	1:capture at once
1027H	Intervals of trending record	60	1~60

1028H	TOU enable	1	Only1 works
1029H	TOU default enable	1	Only 1 works
102AH	Real time energy clearance	1	Only 1 works
102BH	TOU monthly accounting mode	0	1: assigned time 0: end of month
102CH	TOU monthly accounting time : day	15	1~31
102DH	TOU monthly accounting time : hour	0	0~23
102EH	TOU monthly accounting time : minute	0	0~59
102FH	TOU monthly accounting time : second	0	0~59
1030H	Energy freezing mode	0	1:assigned time 0:at once
1031H	Freezing at once	1	Only 1 works
1032H	Freezing time : hour	0	0~23
1033H	Freezing time : minute	0	0~59
1034H	Freezing time : second	0	0~59
1035H	TOU energy clear mode	0	1:assigned time 0:at once
1036H	TOU energy clear at once	1	Only 1 works
1037H	TOU clear time : month	1	1~12
1038H	TOU clear time : day	1	1~31
1039H	TOU clear time : hour	0	0~23
103AH	TOU clear time : minute	0	0~59
103BH	TOU clear time : second	0	0~59
103CH	Run time clear	1	Only1 works
103DH	Alarming flash enable	1	Only 1 works
103EH	Energy measure mode	1	0:base harmonic 1: all

103FH	Apparent power measuring mode	1	0,1
1040H	DI triggering demand synchronization enable	0	0~4
1041H	DI triggering condition	1	1~3

To know more about these parameters, please refer to chapters 3 and 4.

System Status Parameter

"System status" indicates what events happened in the meter, what kinds of flags are read by the user and to be the index of the storage of the events. Flags should be clear after being read by the controller, otherwise new data will not store properly.

Function code: 03H for Reading, 10H for writing, data type: word.

Address	***Parameter***	***Range***	***Format code***
1046H	system status	Bit0:new SOE Bit1:new waveform Bit2:new alarming Bit3:new trending	F1
1047H~105AH	Status flags for the 1~20th records of SOE	1:new data	F1
105BH~105FH	Status flags for the 1~5th records of waveform capture	1:new data	F1
1060H~106FH	Status flags for the 1~16th records of alarming	1:new data	F1
1070H	Backup pointer of trending record	0~355	F1

Read-only Record Pointer and its Status

"Pointer" is the index number of the addresses of coming-up records." 0"stands for the first group of records,"1" stands for the second group of records and so on.

The data type is "word".

The pointer and its status are produced by the meter, the controller can only read them but not change them.

address	parameter	range	Format code
1078H	Pointer of SOE	0~19	F1
1079H	Pointer of waveform	0~4	F1
107AH	Pointer of alarming	0~15	F1
107BH	Pointer of trending	0~335	F1
107CH	TOU Time checking report	0:right,1:wrong	F1

Running Time

Accumulating meter's running time: It can be cleared via communication, but data changing is not allowed.

Function code: 03H for Reading. The data type is "dword".

Address	Parameter	Range	Format code
107DH(high)	Running time	0~999999999	F2
107EH(low)			

Date and Time Table

Function code: 03 for Reading, 16 for Presetting.

Address	Parameter	Range	Format code
1080H	Year	2000~2099	F3
1081H	Month	1~12	F3
1082H	Day	1~31	F3
1083H	Hour	0~23	F3
1084H	minute	0~59	F3
1085H	second	0~59	F3

Energy Measurement

All the addresses of energy registers are here. There are lots of registers including calendar setting, real time energy, energy freezing, current month TOU and last month TOU registers. Their relationship is shown below:

Statistics:

1. real time energy
2. TOU:
    - a): current month TOU
    - b): last month TOU
    - c): accumulating TOU

Freezing:

1. real time frozen
2. current month frozen
3. accumulating frozen

Function code: 03H for Reading, 10H for writing, data type: word.

Address	Parameter	Range	Format code
1086H	First schedule, enable it or not	1:enable; 0:disable	F1

1087H~108BH	Start time of first schedule: mm:dd:hh:mm:ss	Time	F3
108CH~1090H	End time of first schedule: mm:dd:hh:mm:ss	Time	F3
1091H	First interval enable or not	1:enable; 0:disable	F1
1092H~1094H	Start time of first interval: hh:mm:ss	0~23	F3
1095H~1097H	End time of first interval: hh:mm:ss	0~23	F3
1098H	Fee type of first interval	0:sharp,1:peak, 2:valley,3:normal	F1
1099H~10A0H	The second interval	Same as the first interval	
10A1H~10A0H	The third interval	Same as the first interval	
10A9H~10A8H	The fourth interval	Same as the first interval	
10B1H~10B0H	The fifth interval	Same as the first interval	
10B9H~10B8H	The sixth interval	Same as the first interval	
10C1H~10C0H	The seventh interval	Same as the first interval	
10C9H~10C8H	The eighth interval	Same as the first interval	
10D1H~10D0H	The second schedule	Same as the first schedule	
111CH~1166H	The third schedule	Same as the first schedule	
1167H~11B1H	The fourth schedule	Same as the first schedule	

Real Time Energy Measurement

Data stored in this block can be reset or cleared.

Function code: 03H for Reading, 10H for writing, data type: dword.

Address	***Parameter***	***Range***	***Format code***
11B2H(high) 11B3H(low)	Consumption energy	0~99999999.9	F4

11B4H~11C3H	In series, they are generation energy, inductive energy, capacitive energy, absolute sum of imp and exp energy, algebraic sum of imp and exp energy, absolute sum of the reactive energy, algebraic sum of reactive energy, Apparent energy.	0~99999999.9	F4 F5 F6

Energy Freezing

Energy freezing is to copy real time energy, current month TOU energy, andaccumulating TOU energy without affecting any existing data and record the freezing time as well. Function code: 03H for Reading, data type: dword. Format code: F3

Address	***Parameter***	***Range***
11C4H~11C9H	Freezing time: yyyy:mm:dd:mm:ss	time
Following are the accumulating TOU table		
11CAH (high 16 bits) 11CBH (low 16 bits)	Phase A consumption energy(sharp)	0~999999999
11CCH~125BH	In series, they are Phase A consumption energy(sharp), phase A generation energy(sharp), phase A inductive energy(sharp), phase A capacitive energy(sharp), Phase A consumption energy(peak), phase A generation energy(peak), phase A inductive energy(peak), Phase A consumption energy(valley), phase A generation energy(valley), phase A inductive energy(valley), Phase A consumption energy(normal), phase A generation energy(normal), phase A inductive energy(normal), Phase B consumption energy(sharp), Phase B generation energy(sharp), Phase B inductive energy(sharp), Phase B capacitive energy(sharp), Phase B consumption energy(peak), Phase B generation energy(peak), Phase B inductive energy(peak), Phase C consumption energy(valley), Phase B generation	

	energy(valley), Phase B inductive energy(valley), Phase B consumption energy(normal), Phase B generation energy(normal), Phase B inductive energy(normal), Phase C consumption energy(sharp), Phase C generation energy(sharp), Phase C inductive energy(sharp), Phase C capacitive energy(sharp), Phase C consumption energy(peak), Phase C generation energy(peak), Phase C inductive energy(peak), Phase C consumption energy(valley), Phase C generation energy(valley), Phase C inductive energy(valley), Phase C consumption energy(normal), Phase C generation energy(normal), Phase C inductive energy(normal), Three phase consumption energy(sharp), Three phase generation energy(sharp), Three phase inductive energy(sharp), Three phase capacitive energy(sharp), Three phase Apparent energy(sharp), Three phase consumption energy(peak), Three phase generation energy(peak), Three phase inductive energy(peak), Three phase Apparent energy(peak), Three phase consumption energy(valley), Three phase generation energy(valley), Three phase inductive energy(valley), Three phase Apparent energy(valley), Three phase consumption energy(normal), Three phase generation energy(normal), Three phase inductive energy(normal), Three phase Apparent energy(normal), Three phase consumption energy(all), Three phase generation energy(all), Three phase inductive energy(all), Three phase Apparent energy(all),
125CH~12EDH	Current month TOU freezing, the same as the accumulating TOU table in series
12EEH~12FFH	Real time energy freezing, the same as the Real time energy measurement

TOU of Last Month

Balance time and values of TOU are stored here. Function code: 03H for Reading,

Address	*Parameter*	*Range*	*Format code*
1300H~1305H	Month balance time: yyyy:mm:dd:hh:mm:ss	time	F3
1306H~1397H	the same as the accumulating TOU table in series		

TOU of Current Month

TOU of current month is stored here. It refreshes every second and clears at the balance time. Function code: 03H for Reading, 10H for writing.

Address	**Parameter**	**Range**	**Format code**
142AH~14BBH	the same as the accumulating TOU table in series		

Three phase consumption energy (all), three phase generation (all), three phase absorption reactive (all), three phase generation reactive (all) and three phase consumption, three phase generation, three phase absorption reactive , three phase generation reactive are the same physically, but their data may differ because they are controlled by different clearances. The former is cleared at the TOU clearance time while the latter is cleared at the real time clearance time. Furthermore, if the TOU function is disabling, the former will cease without any effect of the latter.

Event Alarming Setting

There are 16 groups of records with the same format. Function code: 03H for Reading, 10H for writing. Please refer to chapter 4 for more details.

Address	**Parameter**	**Range**	**Format code**
14F0H	First group: serial number	0~246	F1
14F1H	First group: comparison mode	1:more,2:equal,3:less	F1
14F2H	First group: setting value	Related with parameters	F7~F21
14F3H	First group: delay	0~6000(*10ms)	F1
14F4H	First group: waveform capture	1:capture, 0:not capture	F1
14F5H~153FH	2ed to 16th group	Same as the first group	

Alarming Records

There are 16 groups of records with the same format. Function code: 03H for Reading, 10H for writing. Please refer to chapter 4 for more details.

Address	Parameter	Range	Format code
1540H	First group: alarming status	0~65536	F1
1541H	First group: parameter number	0~246	F1
1542H	First group: over range or reset value	Related with parameters	F7~F21
1543H~1549H	First group: occur time: yyyy:mm:dd	time	F3
154AH~15DF	2ed to 16th group	Same as the first group	

SOE

There are 20 groups of records with the same format. Function code: 03H for Reading, 10H for writing. Please refer to chapter 4 for more details.

Address	Parameter	Range	Format code
15E0H	First group: DI status	0~16	F1
15E1H~15E7H	First group: occur time: yyyy:mm:dd:hh:mm:ss	time	F3
15E8H~167FH	2ed to 20th group	Same as the first group	

Waveform Record

There are 5 groups of records including capture time, trigger condition and waveform data with the same format. The relationship between voltage waveform data and the numerical value is: numerical value (V) = waveform data*0.2525. The relationship between current waveform data and the numerical value is: numerical value (A)= waveform data*0.003071. Waveform data are secondary values of PT or CT.

Function code: 03H for Reading, 10H for writing. Please refer to chapter 4 for more details.

Address	Parameter	Range	Data type
1680H~1686H	First group: occur time: yyyy:mm:dd:hh:mm:ss:ms	time	Word
1687H	First group: trigger condition	0~255	Word
1688H	First group: alarming trigger	0~65535	Word
1689H	First group: manual trigger	0~1	Word
168AH~1729H	First group:10 cycles of UA	-32768~32767	Int
172AH~17C9H	First group: 10 cycles of IA	-32768~32767	Int
17CAH~1869H	First group: 10 cycles of UB	-32768~32767	int
186AH~1909H	First group: 10 cycles of IB	-32768~32767	Int
190AH~19A9H	First group: 10 cycles of UC	-32768~32767	Int
19AAH~1A49H	First group: 10 cycles of IC	-32768~32767	Int
1A4AH~2971H	2ed to 5th group	Same as the first group	

Trending Records

There are 336 groups of records with the same format. Function code: 03H for Reading, 10H for writing. Please refer to chapter 4 for more details.

Address	Parameter	Range	Format code
2972H~2977H	Latest record time: yyyy:mm:dd:hh:mm:ss	Time	F3
2978H	First group: frequency	0~7000	F13
2979H	First group: voltage UA(UAB)	0~65535	F7
297AH	First group: current IA	0~65535	F8
297BH	First group: voltage UB(UBC)	0~65535	F7
297CH	First group: current IB	0~65535	F8
297DH	First group: voltage UC(UCA)	0~65535	F7
297EH	First group: current IC	0~65535	F8
297FH~32A7H	Same as the first group		

Voltage Eligibility

Function code: 03H for Reading, 10H for writing, data type: word.

Address	Parameter	Range	Format code
32A8H	High limit of U1(U12)	0~65535	F7
32A9H	Low limit of U1(U12)	0~65535	F7
32AAH	High limit of U2(U23)	0~65535	F7
32ABH	Low limit of U2(U23)	0~65535	F7
32ACH	High limit of U3(U31)	0~65535	F7
32ADH	Low limit of U3(U31)	0~65535	F7
32AEH	clearance mode	0:at once, 1:assign	F1
32AFH	clear at once	0:no,1:yes	F1
32B0H~32B5H	clearing time: yyyy:mm:dd:hh:mm:ss	Time	F3
32B6H	freezing mode	0:at once, 1:assign	F1
32B7H	Freezing at once	0:no,1:yes	F1
32B8H~32BDH	Freezing time: yyyy:mm:dd:hh:mm:ss	Time	F3

Voltage Eligibility consists of running time, channel eligibility and eligible time. In order to find and analyze, it is divided into real time zone, statistics zone, and freezing zone. Data type of time is “float” with the unit “ms”. Data type of eligibility is “dword”

Real Time Measurement

Address	Parameter	Range	Format code
The following are statistics including running time and eligible time			
32CEH,32CFH	Day: running time	0.0~3.402823E +38	F24
32D0H,32D1H	Day: eligible time of UA(UAB)	0.0~3.402823E +38	F24
32D2H,32D3H	Day: eligible time of UB(UBC)	0.0~3.402823E +38	F24
32D4H,32D5H	Day: eligible time of UC(UCA)	0.0~3.402823E +38	F24

32D6H,32D7H	Day: eligible time of three phase	0.0~3.402823E +38	F24
32D8H~32E1H	month: same as day	0.0~3.402823E +38	F24
32E2H~32EBH	Year: same as day	0.0~3.402823E +38	F24
32ECH~32F5H	Accumulation: same as day	0.0~3.402823E +38	F24
The following are statistics of Voltage Eligibility			
32F6H,32F7H	Day: eligibility of UA(UAB)	0~1000000000	F23
32F8H,32F9H	Day: eligibility of UB(UBC)	0~1000000000	F23
32FAH,32FBH	Day: eligibility of UC(UCA)	0~1000000000	F23
32FCH,32FDH	Day: eligibility of three phase	0~1000000000	F23
32FEH~3305H	month: same as day	0~1000000000	F23
3306H~330DH	Year: same as day	0~1000000000	F23
330EH~3314H	Accumulation: same as day	0~1000000000	F23

Freezing Zone:

Real time data will cover the freezing zone after voltage eligibility is frozen while real time measurement keeps going on. The address range is 316H~335dH.You can use the 03H function to read it.

Statistics Zone:

When the day changes, the data of real time measurement will be stored in the statistics zone. The “day” data will clear and restart.

Address	***Parameter***	***Range***	***Format code***
The following are statistics including running time and eligible time			
335EH,335FH	Day: running time	0.0~3.402823E +38	F24
3360H,3361H	Day: eligible time of UA(UAB)	0.0~3.402823E +38	F24
3362H,3363H	Day: eligible time of UB(UBC)	0.0~3.402823E +38	F24
3364H,3365H	Day: eligible time of UC(UCA)	0.0~3.402823E +38	F24
3366H,3367H	Day: eligible time of three phase	0.0~3.402823E +38	F24
3368H~3371H	month: same as day	0.0~3.402823E +38	F24

3372H~337BH	Year: same as day	0.0~3.402823E +38	F24
The following are statistics of Voltage Eligibility			
337CH,337DH	Day: eligibility of UA(UAB)	0~1000000000	F23
337EH,337FH	Day: eligibility of UB(UBC)	0~1000000000	F23
3380H,3381H	Day: eligibility of UC(UCA)	0~1000000000	F23
3382H,3383H	Day: eligibility of three phase	0~1000000000	F23
3384H~338BH	month: same as day	0~1000000000	F23
338CH~3393H	Year: same as day	0~1000000000	F23

Voltage eligibility related Records including time of statistics, clearing time and freezing time. Data type is “word”.

Address	***Parameter***	***Range***	***Format code***
3394H~3399H	Refresh time of day statistic: yyyy:mm:dd:hh:mm:ss	Time	F3
339aH~339fH	Refresh time of month statistic: yyyy:mm:dd:hh:mm:ss	Time	F3
33a0H~33a5H	Refresh time of year statistic: yyyy:mm:dd:hh:mm:ss	Time	F3
33a6H~33abH	Clear time of Voltage eligibility parameters: yyyy:mm:dd:hh:mm:ss	Time	F3
33acH~33b1H	Freezing time of Voltage eligibility parameters: yyyy:mm:dd:hh:mm:ss	Time	F3

Basic Analog Measurements

The Relationship between the numerical value in the register and the real physical value is in the following table. (Rx is the numerical value in the register).

Function code: 03H for Reading,

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Address	Parameter	Relationship	Unit
4000H,4001H	Frequency	F=Rx / 100	Hz
4002H,4003H	Phase voltage	V1 U=Rx X (PT1 / PT2)	V
4004H,4005H	Phase voltage	V2 U=Rx X (PT1 / PT2)	V
4006H,4007H	Phase voltage	V3 U=Rx X (PT1 / PT2)	V
4008H,4009H	Average voltage	Vvavg U=Rx X (PT1 / PT2)	V
400aH,400bH	Line voltage	V12 U=Rx X (PT1 / PT2)	V
400cH,400dH	Line voltage	V23 U=Rx X (PT1 / PT2)	V
400eH,400fH	Line voltage	V31 U=Rx X (PT1 / PT2)	V
4010H,4011H	Average line voltage	Vlavg U=Rx X (PT1 / PT2)	V
4012H,4013H	Phase(line)current I1	I=Rx X(CT1/5)	A
4014H,4015H	Phase(line)current I2	I=Rx X(CT1/5)	A
4016H,4017H	Phase(line)current I3	I=Rx X(CT1/5)	A
4018H,4019H	Average current Iavg	I=Rx X(CT1/5)	A
401aH,401bH	Middle line voltage	VIN I=Rx X(CT1/5)	A
401cH,401dH	Phase A power Pc	P=Rx X (PT1 / PT2) X (CT1/5)	W
401eH,401fH	Phase B power Pb	P=Rx X (PT1 / PT2) X (CT1/5)	W
4020H,4021H	Phase C power Pc	P=Rx X (PT1 / PT2) X (CT1/5)	W
4022H,4023H	System power Psum	P=Rx X (PT1 / PT2) X (CT1/5)	W
4024H,4025H	Phase A reactive power Qa	P=Rx X (PT1 / PT2) X (CT1/5)	W
4026H,4027H	Phase B reactive power Qa	P=Rx X (PT1 / PT2) X (CT1/5)	W
4028H,4029H	Phase C reactive power Qb	P=Rx X (PT1 / PT2) X (CT1/5)	W
402aH,402bH	System reactive power Qc	P=Rx X (PT1 / PT2) X (CT1/5)	W

402cH,402dH	Phase A Apparent power Sa	S=Rx X (PT1 / PT2) X (CT1/5)	VA
402eH,402fH	Phase B Apparent power Sb	S=Rx X (PT1 / PT2) X (CT1/5)	VA
4030H,4031H	Phase C Apparent power Sc	S=Rx X (PT1 / PT2) X (CT1/5)	VA
4032H,4033H	System Apparent power Sa	S=Rx X (PT1 / PT2) X (CT1/5)	VA
4034H,4035H	Phase A power factor PFa	PF =Rx / 1000	None
4036H,4037H	Phase B power factor PFb	PF =Rx / 1000	None
4038H,4039H	Phase C power factor PFc	PF =Rx / 1000	None
403aH,403bH	System power factor PFsum	PF =Rx / 1000	None
403cH,403dH	Voltage unbalance factor U_unbl	Unbl=Rx X 100%	None
403eH,403fH	Current unbalance factor I_unbl	Unbl=Rx X 100%	none
4040H,4041H	Load characteristic(R/L/C)	76.0/67.0/82.0	none

Harmonics:

THD, Harmonics, evenHD, oddHD, Crest Factor, TIF, K factor etc are all stored here. The data type is “word”. Voltage parameters refer to line voltage when it is set to “2LL” and phase voltage for others. Function code: 03H for Reading.

Address	***Parameter***	***Range***	***Format code***
The following are the THD of voltage and current			
4042H	THD_V1 of V1(V12)	0~10000	F15

4043H	THD_V1 of V2(V23)	0~10000	F15
4044H	THD_V1 of V3(V31)	0~10000	F15
4045H	THD_V	0~10000	F15
4046H	THD_I1	0~10000	F15
4047H	THD_I2	0~10000	F15
4048H	THD_I3	0~10000	F15
4049H	THD_I	0~10000	F15
Voltage Harmonics, evenHD, oddHD, Crest Factor, TIF, K factor are shown as below			
404aH~4067H	Harmonics of V1(V12) (the 2nd to 31st)	0~10000	F16
4068H	evenHD of V1(V12)	0~10000	F17
4069H	OddHD of V1(V12)	0~10000	F18
406aH	Crest Factor of V1(V12)	0~65535	F19
406bH	TIF of V1(V12)	0~10000	F21
406cH~408dH	Parameters of V2(V23)	0~10000	
408eH~40afH	Parameters of V3(V31)	0~10000	
Current Harmonics, evenHD, oddHD, Crest Factor, TIF, K factor are shown as below			
40b0H~40cdH	Harmonics of I1 (the 2nd to 31st)	0~10000	F16
40ceH	evenHD of I1	0~10000	F17
40cfH	OddHD of I1	0~10000	F18
40d0H	K Factor of I1	0~65535	F19
40d1H~40f1H	Parameters of I2	0~10000	
40f2H~4112H	Parameters of I3	0~10000	

Demand

Function code: 03H for Reading, data type is “word, addresses of parameter memories are the same in series.

Address	*Parameter*	*Range*	*Format code*
411eh~4123H	Update time of last record yyyy:mm:dd:hh:mm:ss	time	F3
All demands of positive power demand of A phase are shown below			

4124H	Last positive power demand of phase A	0~32767	F3
4125H	Current positive power demand of phase A	0~32767	F3
4126H	Peak positive power demand of phase A	0~32767	F3
4127H~412cH	Occur time of Peak positive power demand: yyyy:mm:dd:hh:mm:ss	time	F3
412dH~4135H	positive power demand of phase B(like positive power demand of A phase)		F9
4136H~413eH	positive power demand of phase C (like positive power demand of A phase)		F9
413fH~4147H	negative power demand of phase A(like positive power demand of A phase)		F9
4148H~4150H	negative power demand of phase B(like positive power demand of A phase)		F9
4151H~4159H	negative power demand of phase C(like positive power demand of A phase)		F9
415Ah~4162H	Inductive power demand of phase A(like positive power demand of A phase)		F10
4163H~416bH	Inductive power demand of phase B(like positive powerdemand of A phase)		F10
416Ch~4174H	Inductive power demand of phase C (like positive power demand of A phase)		F10
4175H~417dH	capacitive power demand of phase A(like positive power demand of A phase)		F10
417Eh~4186H	capacitive power demand of phase B(like positive power demand of A phase)		F10
4187H~418fH	capacitive power demand of phase C(like positive powerdemand of A phase)		F10
4190H~4198H	positive power demand of three phase(like positive powerdemand of A phase)		F9
4199H~41a1H	negative power demand of three phase(like positive power demand of A phase)		F9

41a2H~41aaH	Inductive power demand of three phase(like positive power demand of A phase)		F10
41abH~41b3H	capacitive power demand of three phase(like positive power demand of A phase)		F10
41b4H~41bcH	Apparent power demand of three phase(like positive power demand of A phase)		F11
41bdH~41c5H	I1 demand(like positive power demand of A phase)		F8
41c6H~41ceH	I2 demand(like positive power demand of A phase)		F8
41cfH~41d7H	I3 demand(like positive power demand of A phase)		F8
41d8H~41e0H	average current demand(like positive power demand of A phase)		F8
Predict demand are shown below			
41e1H	negative power predict demand of three phase	0~32767	F9
41e2H	positive power predict demand of three phase	0~32767	F9
41e3H	Inductive power predict demand of three phase	0~32767	F10
41e4H	capacitive power predict demand of three phase	0~32767	F10
41e5H	Apparent power predict demand of three phase	0~32767	F11

MAX/MIN record

MAX/MIN and related time. Function code: 03H for Reading.

Address	Parameter	Range	Format code
41e6H	MAX of V1	0~65535	F7
41e7H~41ecH	Occur time: yyyy:mm:dd:hh:mm:ss	time	F3
41edH	MAX of V2	0~65535	F7
41efH~41f3H	Occur time: yyyy:mm:dd:hh:mm:ss	time	F3
41f4H	MAX of V3	0~65535	F7
41f5H~41faH	Occur time: yyyy:mm:dd:hh:mm:ss	time	F3
41fbH	MAX of V12	0~65535	F7
41fcH~4201H	Occur time: yyyy:mm:dd:hh:mm:ss	time	F3
4202H	MAX of V23	0~65535	F7
4203H~4208H	Occur time: yyyy:mm:dd:hh:mm:ss	time	F3
4209H	MAX of V31	0~65535	F7
420aH~420fH	Occur time: yyyy:mm:dd:hh:mm:ss	time	F3
4210H	MAX of I1	0~65535	F8
4211H~4216H	Occur time: yyyy:mm:dd:hh:mm:ss	time	F3
4217H	MAX of I2	0~65535	F8
4218H~421dH	Occur time: yyyy:mm:dd:hh:mm:ss	time	F3
421eH	MAX of I3	0~65535	F8
421fH~4224H	Occur time: yyyy:mm:dd:hh:mm:ss	time	F3
4225H	MAX of system power	-32768~32767	F9
4226H~422bH	Occur time: yyyy:mm:dd:hh:mm:ss	time	F3
422cH	MAX of system reactive power	-32768~32767	F10
422dH~4232H	Occur time: yyyy:mm:dd:hh:mm:ss	time	F3
4233H	MAX of system apparent power	0~65535	F11
4234H~4239H	Occur time: yyyy:mm:dd:hh:mm:ss	Time	F3
423aH	MAX of power factor	-1000~1000	F12
423bH~4240H	Occur time: yyyy:mm:dd:hh:mm:ss	Time	F3

4241H	MAX of frequency	0~7000	F13
4242H~4247H	Occur time: yyyy:mm:dd:hh:mm:ss	time	F3
4248H	MAX of power demand	-32768~32767	F9
4249H~424eH	Occur time: yyyy:mm:dd:hh:mm:ss	time	F3
424fH	MAX of reactive power demand	-32768~32767	F10
4250H~4255H	Occur time: yyyy:mm:dd:hh:mm:ss	time	F3
4256H	MAX of apparent power demand	0~65535	F11
4257H~425cH	Occur time: yyyy:mm:dd:hh:mm:ss	time	F3
425dH	MAX of voltage unbalance factor	0~65535	F14
425eH~4263H	Occur time: yyyy:mm:dd:hh:mm:ss	time	F3
4264H	MAX of current unbalance factor	0~65535	F14
4265H~426aH	Occur time: yyyy:mm:dd:hh:mm:ss	time	F3
426bH	MAX of V1(V12) THD	0~65535	F15
426cH~4271H	Occur time: yyyy:mm:dd:hh:mm:ss	time	F3
4272H	MAX of V2(V23) THD	0~65535	F15
4273H~4278H	Occur time: yyyy:mm:dd:hh:mm:ss	time	F3
4279H	MAX of V3(V31) THD	0~65535	F15
427aH~427fH	Occur time: yyyy:mm:dd:hh:mm:ss	time	F3
4280H	MAX of I1	0~65535	F15
4281H~4286H	Occur time: yyyy:mm:dd:hh:mm:ss	time	F3
4287H	MAX of I2	0~65535	F15
4288H~428dH	Occur time: yyyy:mm:dd:hh:mm:ss	time	F3
428eH	MAX of I3	0~65535	F15
428fH~4294H	Occur time: yyyy:mm:dd:hh:mm:ss	time	F3
4295H~4343H are the address of previous parameters' MIN having the same format			
The following are the backups			
4344H~4349H	Backup time: yyyy:mm:dd:hh:mm:ss	time	F3
434aH~43f8H is for previous parameters' MAX backup(last day or last month)			
4423H~44a7H is for previous parameters' MIN backup(last day or last month)			

Sequence Component

U1 (U12), I1 consist of real and complex parts. They have positive sequence, negative sequence and zero sequence. Data type is “int”.

Function code: 03H for Reading.

Address	Parameter	Range	Format code
44a8H	positive sequence real part of UA	-32768~32767	F7
44a9H	positive sequence complex part of UA	-32768~32767	F7
44aaH	negative sequence real part of UA	-32768~32767	F7
44abH	negative sequence complex part of UA	-32768~32767	F7
44acH	zero sequence real part of UA	-32768~32767	F7
44adH	zero sequence complex part of UA	-32768~32767	F7
44aeH	positive sequence real part of IA	-32768~32767	F8
44afH	positive sequence complex part of IA	-32768~32767	F8
44b0H	negative sequence real part of IA	-32768~32767	F8
44b1H	negative sequence complex part of IA	-32768~32767	F8
44b2H	zero sequence real part of IA	-32768~32767	F8
44b3H	zero sequence complex part of IA	-32768~32767	F8

Phase Angle

All voltage and current’s phase angles corresponding to V1 (V12) are stored here. You can find out the phase sequence according to them. Data type is “word”.

Function code: 03H for Reading.

Address	Parameter	Range	Format code
44b4H	phase angle of V2 to V1	0~3600	F22
44b5H	phase angle of V3 to V1	0~3600	F22
44b6H	phase angle of V2 to V1	0~3600	F22
44b7H	phase angle of I2 to V1	0~3600	F22

44b8H	phase angle of I3 to V1	0~3600	F22
44b9H	phase angle of V23 to V12	0~3600	F22
44baH	phase angle of I1 to V12	0~3600	F22
44bbH	phase angle of I2 to V12	0~3600	F22
44bcH	phase angle of I3 to V12	0~3600	F22

DI Status: Current DI Status,

Function code: 02H for Reading.

Address	Parameter	Range	Data type
0000H	DI1	1 = ON , 0 = OFF	bit
0001H	DI2	1 = ON , 0 = OFF	bit
0002H	DI3	1 = ON , 0 = OFF	bit
0003H	DI4	1 = ON , 0 = OFF	bit

Relay Status:

Function code: 02H for Reading, 05H for controlling output.

Address	Parameter	Range	Data type
0000H	RELAY1	1 = ON , 0 = OFF	bit
0001H	RELAY2	1 = ON , 0 = OFF	bit

Appendix

Appendix A Technical Data and Specifications

Appendix B Ordering Information

Appendix A Technical data and specifications

Input Ratings

Voltage Input	
Voltage rating	40~230VAC LN, 60~400VAC L-L with 20% over range Category III, Pollution degree 2
Frequency range	45~65Hz
Overload	2 times for continue, 2500Vac for 1 Sec (None recurrence)
Voltage range through PT	500KV highest at primary side
PT burden	<0.2VA
Measuring	True RMS

Current Input	
Current rating	5Amp AC nominal F.S. input with 20% over range. 1Amp (Optional)
Current range	50000A highest at primary side
Overload	10A for continuous 100A for 1 Sec(None recurrence)
CT burden	< 0.5VA
Measuring	True RMS

Accuracy

Parameter	***Accuracy***
Voltage[1]	0.2%
Current[2]	0.2%
Power	0.5%
Reactive Power	0.5%
Apparent Power	0.5%
Power Factor	0.5%
Frequency	0.2%
Energy	0.5%
Reactive Energy	0.5%
THD	1.0%
Unbalance Factor	0.5%
Drift with Temperature	Less than 100ppm/□
Stability	0.5‰/year

Note: 1. Accuracy of directly measured voltage: 0.2%, Accuracy of indirectly measured (Calculated) voltage: 0.5%
2. Accuracy of directly measured current: 0.2%, Accuracy of indirectly measured (Calculated) current: 0.5%

Standards	
Measuring	IEC 60253-22 0.5S IEC 60253-23
Environmental	IEC 60068-2
Safety	IEC 61010-1
EMC	IEC 61000-4/2-3-4-5-6-8-11
Dimension	DIN43700

Digital Input (DI)	
Optical Isolation Isolate voltage	2500Vac rms
Input Type	Wet contact (Contact with power supply)
Input resistance	2K ohm (typical)
Input voltage range	5~30Vdc
Close voltage	> 10Vdc
Max input current	20mA
DI Aux Power	15Vdc/60mA
Resolving power of SOE	1ms

Digital Output (DO)	
Output Form	Photo-MOS, NO
Optical Isolation	2500Vac rms
Max Positive Voltage	100Vdc
Max Positive Current	50mA

Relay Output (Relay)	
Output Form	Mechanical Contact, NO
Contact Resistance	30m ohm@1A
Max Break Voltage	250Vac,30Vdc,
Max Break Current	3A
Max Isolated Voltage	2500Vac rms

Suitable Conditions	
Dimensions (mm)	96x96x72 (Cut -out90x90)
Protection Level	IP52 (Front) IP20 (Cover)
Weight (g)	350
Temperature	-25□~70□, Metering -10□~70□, Display -40□~85□, Storage
Humidity	0~95% Non-condensing
Power Supply	100-240Vac (±10%,50~60Hz) 100-300Vdc (±10%)
Power Consumption	3W

Communication Port	
Type	RS485, Half Duplex, Optical Isolated
Protocol	Modbus RTU
Baud Rate	1200~38400bps

Appendix B ORDERING INFORMATION

DPMS XPQ

D-------DPMS XPQ-D
E-------DPMS XPQ-E
F-------DPMS XPQ-F
G------DPMS XPQ-G

D: Base unit with metering measurement package and 4 digital inputs, 2 solid-state digital outputs, 2 relay outputs, RS-485 Comm port w/Modbus.

E: Base unit with PQ trending package (min/max), 4 digital inputs, 2 solid-state digital outputs, 2 relay outputs, RS-485 Comm port w/ Modbus.

F: Base unit with PQ trending package (min/max), waveform capture, 4 digital inputs, 2 solid-state digital outputs, 2 relay outputs, RS-485 Comm port w/Modbus.

G: Base unit with PQ trending package (min/max), waveform capture, metering measurements, 4 digital inputs, 2 solid-state digital outputs, 2 relay outputs, RS-485 Comm port w/Modbus

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